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UNIVERSITY OF THE WITWATERSRAND

Wits School of Education

Masters in Education Research Report

By

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Research Topic: Factors enabling and constraining the pedagogical integration of ICTs in a South African school

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Declaration

I the undersigned hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted this work to any other university for a degree.

_____ _____

Signature Date

Abstract

As ICTs become more and more ubiquitous in institutions of education, schools are faced with the challenge of integrating ICTs pedagogically. More schools in South Africa have ICT resources available; however, their integration levels have not advanced at the rate that technology is progressing (Pan African Research Agenda on the Pedagogical Integration of Information and Communications Technologies, 2008). There are several enablers and constraining factors that have an impact on the schools' capacity to pedagogically integrate ICTs. This is a case study of an ex-model C primary school in the Gauteng province. The school under study is one of the ten South African institutions from which the Pan African Research Agenda on the Pedagogical Integration of ICTs (PanAfICT) collected data in 2008 stored in its observatory. The UNESCO model (2002) was used to position this school at a specific level based on factors affecting the teachers' propensity to integrate ICTs pedagogically. The findings of this study suggest that the school has been in the *applying* (second) level, since 2008 and has not made much progress in the implementation of ICT pedagogical integration. It also emerged from this case study that the enabling factors (the availability of a wide range of ICT resources and teacher training in basic ICT application skills) are not enough to enable the school to progress to the next level. It is the quality of technical support, relevance of training, proactive leadership in ICT integration and provision of time, above availability of resources that determine progression in the use of technology in the classroom. The literature selected covers mainly the national ICT integration environments and general views of authors in this field. On the basis of these findings, it is proposed that there is a need for the Department of Education to address the lack of progress in ICT pedagogical integration in schools by monitoring the process and developing strategies that will improve quality in the implementation despite the constraining factors.

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Acronyms

ACOT- Apple Classrooms Of Tomorrow

CAPS- Curriculum Assessment Policy Statements

DoBE- Department of Basic Education

DoE- Department of Education

GDE- Gauteng Department of Education

GoL- Gauteng-on-line

ICT- Information and Communication Technology

ICTiE- Information and Communication Technology in Education

OBE- Outcomes Based education

PanAfICT- Pan African Research Agenda on Pedagogical integration of ICTs

RNCS- Revised National Curriculum Statement

SA- South Africa

SGB- School Governing Body

UNESCO- United Nations Educational, Scientific and Cultural Organisation

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Chapter 1

1.1. Introduction

Recently, there has been a lot of talk about Information and Communication Technologies (ICTs) and their pedagogical use, especially computers in the classroom. The South African education system is experiencing a paradigm shift from using technology for application purposes to the use of ICTs in an integrative mode in the classroom (White Paper on e-Education, 2004). Since we are living in the information age where technologies surround us (Prensky, 2001), there is an extreme need for schools to move into this technological paradigm because schools are teaching the future generation that will need tools and skills to participate effectively in this new society.

The South African government has made a commitment to provide ICTs to all schools so that learners can become skilled in the use of ICTs (White Paper on e-Education, 2004) and be able to contribute to the emerging information society. Although many schools have been equipped with ICTs, there are still many disparities facing ICT use particularly in the classroom.

In 2008, the Pan African Research Agenda on the Pedagogical Integration of ICTs conducted a survey on the pedagogical integration of ICTs (PanAf ICT, 2008) on South African educational institutions and published its findings in its observatory. This database provides empirical evidence that shows that South African schools are facing constraints in the pedagogical integration of ICTs. There seems to be considerable factors in the schools that seem to influence the pedagogical integration of ICTs into teaching and learning and this study attempts to understand them in the context of promoting progress in the implementation process.

1.2. Aim

South African schools need to advance their utilization of ICTs to higher levels so that they can produce learners with ICT skills that can enable them to create knowledge and become lifelong learners as this is the core educational outcome (White Paper on e-Education, 2004). The aim of this research is to find out why some schools are not advancing their use of ICTs in the classroom.

The UNESCO model for ICT integration (2002) was used to determine the level that this particular school is integrating ICTs. Once the level has been identified, the researcher will be in a position to determine if the school has made progress in its pedagogical integration of ICTs and be able to identify and analyse factors that account for the progress or the lack of it.

1.3. Rationale

On reviewing the database from the PanAfICT project (2008), the researcher discovered that most South African schools participating in this study (90%) were integrating ICTs at a lower level, regardless of the presence of computers. Each school had constraining and enabling factors that appeared to have an influence on the level of ICT integration within the curriculum. The variables such as socio-economic status of the location of the schools and the resources seemed not to have a bearing on the institutions' level of integration. That prompted the researcher to undertake this study on a school with a wide variety of resources to try and understand why it was implementing the new teaching approach at the same level as schools with less resources. The expectation is that such a school would lead in the integration of ICTs pedagogically as availability of resources 'ideally' should facilitate an adoption of modern teaching methods and technologies.

The findings from this study may provide some answers for the ICT in education stakeholders (teachers, school management team, school governing body, the department of education and other interested parties) regarding meeting the demands needed to promote ICT pedagogical integration and in providing the basis for improving the levels of ICT integration in schools. The results of this research may also benefit the school under study by indicating where it is and what factors it needs to prioritize if it is to advance in its use of ICTs for educational purposes.

1.4. Problem statement

Undoubtedly the need for ICTs has become increasingly essential in our modern society, especially computers; and schools are left with no choice but to use them pedagogically if they are to be relevant. More South African schools have computers and are teaching computer literacy skills, but little integration is taking place. The White Paper on e-Education (2004: 19) states:

> "The policy intention is not just to build technical skills, but also to use ICT to extend and enrich educational experiences across the curriculum. The objective is to build digital and information literacy so that all learners become confident and competent in using technology to contribute to innovative and developing South African society."

There seems to be limitations in the understanding and implementation of the above policy assertion so as to strengthen positive factors that promote creation of environments that endorse ICT pedagogical integration in schools, hence the lack of advancement in the adoption.

The South African curriculum emphasizes the learner centered teaching approach, where learners' ability to construct their own knowledge is developed. ICTs can contribute to the achievement of this educational outcome if used appropriately in the classroom. This outcome has not been achieved by most schools as ICTs are integrated at basic levels that prepare learners for application of computer operational skills instead of those that equip them for use of the tools to construct their own knowledge. The PanAfICT data (2008) reveals that the majority of the South African schools in the project are using ICTs at a basic level regardless of what digital resources they have. That limits their ICT pedagogical integration to lower levels on the UNESCO model (2002).

In view of what is happening in schools with regards to the low levels of ICT integration, this research is interested in understanding the factors that contribute to such practices.

1.5. Research question

What enabling and constraining factors in this school determine its level of ICT pedagogical integration?

Sub-questions

1. What factors influence the ICT pedagogical integration in this school?
2. What is the level of pedagogical integration of ICTs at this school?
3. What factors are likely to promote progression in the pedagogical ICT integration of this school?
4. What factors are disabling the progression in pedagogical integration of ICTs of this school?

Key words for this research

ICT pedagogical integration, ICT **enabling** factors, ICT **constraining** factors, **level** of ICT integration and **progress** towards the higher level of ICT integration.

1.6. Conceptual framework

The implementation of ICT pedagogical integration has been a challenge to all involved in the field of education because of a lack of a theoretical framework that can be used to make sense of issues around its implementation, particularly in the classroom. For that reason, the conceptual framework for this research was not developed from a theory but instead, the UNESCO model (2002) was used to try and understand what would make a school advance its ICT pedagogical integration endeavors by looking closely at its enabling and disabling factors. However, there are very limited models available that describe factors that influence the levels at which schools are integrating ICTs. The preeminent models that illustrate the levels of ICT integration are the UNESCO model (2002) as well as the Apple Classrooms of Tomorrow (ACOT) project (1995). The researcher has used the UNESCO model (2002) to place the level of pedagogical ICT integration in the school under study.

The UNESCO model was selected because it uses school influencing factors to describe each level, that is, what the school has in terms of resources and human capacity. It also points out factors (the constraints) that explain why a school is integrating ICTs at a lower level for instance. The integration levels advance or ascend as the enablers intensify or as the process advances to a desirable level.

The model for the ICT curriculum and teacher development for schools (UNESCO 2002) suggests a four-stage continuum of ICT integration. These are Emerging, Applying, Infusing and Transforming. The figure below illustrates the development of the integration process as the enabling factors are reinforced.

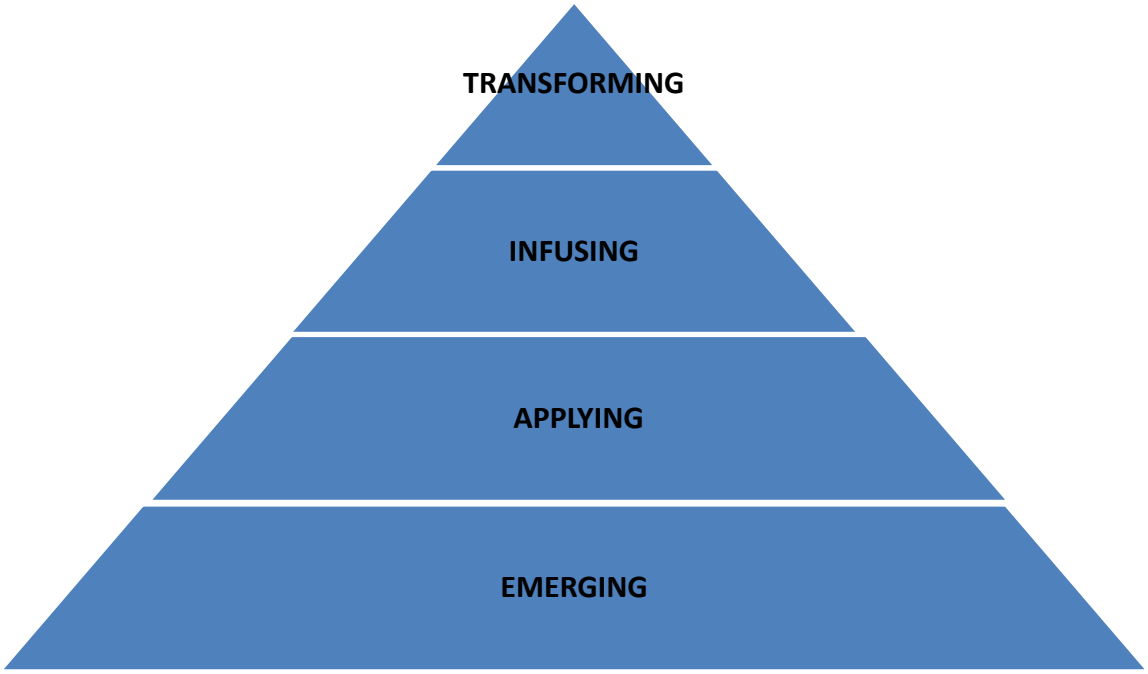


Figure 1.1: UNESCO model (2002) levels of ICT integration

The levels cited in UNESCO (2002) are described as follows:

"Emerging

Schools at the beginning stages of ICT development demonstrate the emerging approach. Such schools begin to purchase, or have donated, some computing equipment and software. In this initial phase, administrators, and teachers are just starting to explore the possibilities and consequences of using ICTs for school management and adding ICTs to the curriculum … Schools at this emerging phase are still firmly grounded in traditional, teacher-centred practices.

- *Applying*

  Those schools in which a new understanding of the contribution of ICTs to learning has developed exemplify the applying approach. In this secondary phase, administrators and teachers use ICTs for tasks already carried out in school management and in the curriculum. Teachers largely dominate the learning environment.

- *Infusing*

  At the next stage, the infusing approach involves integrating or embedding ICTs across the curriculum, and is seen in those schools that now employ a range of computer-based technologies in laboratories, classrooms, and administrative offices. Teachers explore new ways in which ICT changes their personal productivity and professional practice.
- *Transforming*

  Schools that use ICTs to rethink and renew school organization in creative ways are at the transforming approach. ICTs become an integral though invisible part of daily personal productivity and professional practice. ICT is taught as a separate subject at the professional level and is incorporated into all vocational areas. Such schools become centres of learning for their communities" (UNESCO, 2000:15-16).

Based on this model, if the teachers in the school in this study (PanAfICT, 2008) were pedagogically integrating ICTs at a low level, the factors described in the UNESCO model should help the researcher to determine if the school has progressed in the model or not. This conceptual framework, therefore, uses two dimensions of the implementation of the pedagogical integration of ICTs: the factors influencing the integration process and the school current integration level. This model demonstrates that if the intensity of enabling factors overpowers the constraints, the school's level of integration is higher (Infusing or Transformation) but when the constraints overpower the enablers, ICT integration takes place at a lower level (Emerging or Applying). The illustration below attempts to portray the effects of these two dimensions.

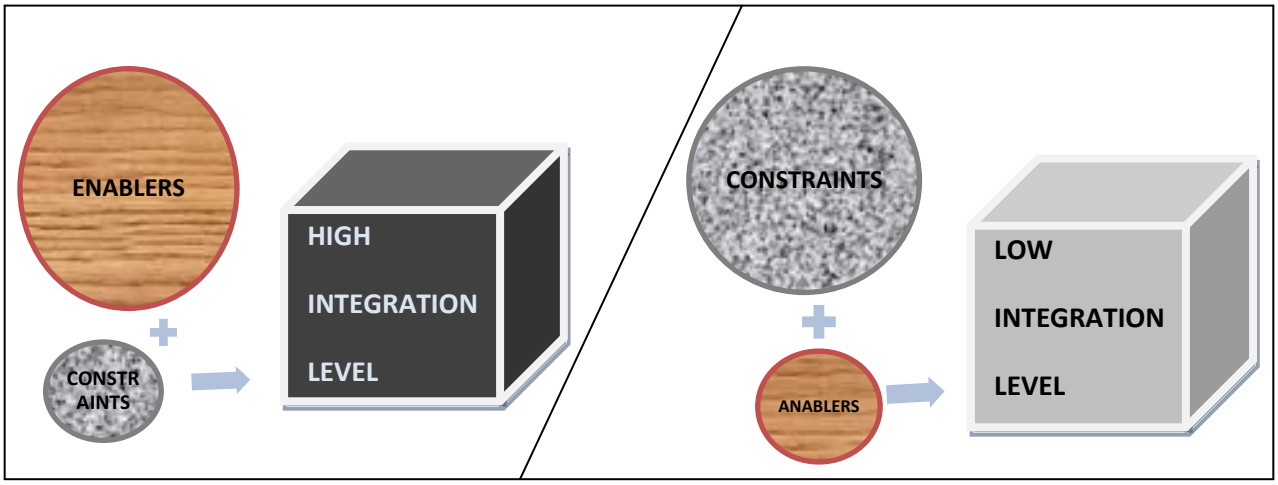


Figure 1.2: Factors influencing integration that impact on the school's level of integration

With this model, a school can then identify its ICT status by evaluating its strengths and weaknesses and then devise strategies of how they can move to the next integration level for the sake of progression.

1.7 Significance of this study

There has been an assumption that well resourced South African public schools with a wide range of ICTs, are integrating ICTs at a high level. These digital technologies have either been donated or purchased from funds that were raised through tireless efforts by the school governing bodies (SGB) or provided by the department of education (DoE). However, these ICTs are not fully utilized to realize the full potential of ICTs in teaching and learning.

This study adds to the wide range of literature that is available on the pedagogical integration of ICTs and will be of benefit to:

DoE: To support schools with appropriate training for ICT pedagogical integration, to work with schools in devising strategies that will promote maximum usage of ICTs in classrooms.

Schools: To understand the importance of ICT integration into teaching and learning and to work towards advancing the utilization of these technologies.

The ICT in education policy must be prioritized with regards to awareness and the implementation of ICT pedagogical integration.

Service providers (training): The development of appropriate ICT courses or workshops that will promote progression in ICT pedagogical integration. These courses must be intensive and incorporate the various skills required to integrate ICTs effectively.
Technical Specialist: The importance of full time technical assistance to assist with technical connections and to avoid unnecessary disturbances during lessons due to technical breakdowns.

1.8 Outline of chapters

The following is an outline of chapters that briefly indicate the stages in the inquiry of this study. The five chapters in this report include:

Chapter 1, this section

Chapter 2 is a review of literature that strengthens the concerns of this study by describing what is happening with regards to the pedagogical integration of ICTs in schools in certain parts of the world. Special attention is given to the factors that are influencing ICTs as either promoting or hindering the progress of ICT integration. The UNESCO level of integration model (2002) is presented as an instrument that will be used later to determine the position of this school.

Chapter 3 is a description of the research design and methodology and further explains the research procedures. Details of the research site, the participants, reliability and ethical considerations as well as data collection, processing and the method used in the analysis of findings is provided.

Chapter 4 presents and critically discusses the findings of the data and attempts to answer the research question on the premise of the data and literature. An attempt to place this school at a particular level of ICT integration is made.

Chapter 5 concludes the study by deliberating on the reality of the implementation of ICT pedagogical integration at this school. Presentation of the findings and recommendations to address the findings is made. Finally, an area for further research that emanates from this study is proposed.

Chapter 2: Literature Review

2.1 Introduction

This literature review aims to identify and understand factors which might enable and constrain the pedagogical integration of ICTs in a South African school. The school under study is part of the Pan African Research Agenda on Pedagogical Integration of ICTs (PanAfICT) (2008), which has an existing publicly available data on this school. The data collected by the researcher from PanAfICT (2008) on this school will be used as evidence to support the claims made by the researcher on the dormant (2008 to present) level of ICT pedagogical integration and the factors that influence it. The rest of the sources have been used to try and comprehend the school's ICT pedagogical integration.

This literature review focuses on the following key aspects: ICT pedagogical integration, ICT policy, leadership, professional development of teachers including attitudes, availability and accessibility of resources, technical support, time and other basic enabling and constraining factors that impact on the pedagogical integration of ICTs.

2.2 Levels of ICT pedagogical integration

The use of ICT integration models that highlight the stages in ICT development is ideal in measuring the extent at which schools are integrating ICTs pedagogically. The use of models assists in providing a framework that stipulates a standard of competency for schools that can help to describe the discrepancies in the pedagogical integration of ICTs in South African schools (PanAfICT, 2008 and Majumdar, 2006). The two models that describe the stages in ICT development are Apple Classrooms of Tomorrow (ACOT, 1995) cited in Strydom et al. (2005) and the UNESCO (2002) model.

ACOT (1995) outlines five stages of development such as: 1) the period of familiarization (Entry), representing baseline exposure to technology; 2) utilization (Adoption), occurring when teachers try the technology; 3) integration (Adaption) beginning the appropriate use of ICT; 4) reorientation (Appropriation) where ICT becomes a part of the learning context and 5) evolution or revolution (Invention) where there is a change in methods and media to facilitate learning.

The UNESCO model describes four stages of development in ICT integration that are emerging, applying, infusing and transforming (already presented in the conceptual framework). The researcher frequently refers to these levels in the literature review.

2.3 **Clarification of terms**

The terms that form the basis of this study and are often used by the researcher are defined with the intention that there is a common understanding and so that all misconceptions are clarified.

2.3.1 ICT pedagogical integration

In an attempt to understand the concept of ICT pedagogical integration, the researcher has defined the terms 'ICT' and 'integration' before explaining the concept in the context of this study first.

ICT

In an educational context, ICT refers to information and communication technologies. ICT refers to a range of technological tools that enable information processing, communication, a means of transmission for teaching, learning and for educational development (Annan, 2005; Tinio, 2002).

ICT integration

ICT integration refers to the regular use of ICTs in teaching and learning in order to improve on educational practices (Annan, 2005). The term integration can be interpreted in two ways. According to Strydom and Thomson (2005), integration can be interpreted as adoption and adaption of ICTs. Adoption is the basic use of ICTs for planning, internet use and administration by teachers out of the classroom. Most schools are adopting ICTs (PanAf, 2008; Strydom and Thomson, 2005). Adaption is the use of ICTs at a high level that promotes interactive learning in the classroom whereby the learners are given opportunities to use ICTs to construct their own knowledge. The rapid development of emerging technologies has prioritized the adaption mode of the integration of ICTs into teaching and learning for the achievement of higher levels of ICT xccintegration (White Paper on e- Education, 2004, Guidelines for Teacher Training and Professional Development in ICT, 2007).

ICT pedagogical integration

ICT pedagogical integration is the transformation of the teaching and learning process in incorporating the curriculum with ICT in such a way that learners are provided with the opportunity to create their own knowledge in an interactive learner – centered environment (Guidelines for Teacher Training and Professional Development, 2007). Lessons presented to the learners enable them to critically engage with the subject matter in a process of assimilating knowledge, analyzing data, communicating interactively with others, evaluating data and transmission of knowledge amongst other essential skills (Papert, 1997). This new teaching approach is a paradigm shift from the traditional teaching methods.

The aim of ICT integrative learning is to aspire towards the pedagogical integration of ICTs (UNESCO, 2002; ACOT, 1995). According to the PanAfICT (2008) data, 10% of the schools are integrating ICTs pedagogically at a high level and the rest (90%) of the schools have adopted this process at a low level. It is in the interest of this study to understand what accounts for this lack of progress in these schools that all are privileged with an enabling factor, which is access to digital resources.

2.3.2 "Enabling" and "constraining" factors

This study regularly refers to the terms 'enable' and 'constrain' as they are the key elements in the understanding of the nature of the pedagogical integration in the school under study. The relationship between the two is first discussed before defining the terms. The absence of enabling factors discussed in this study has an "opposite" effect. This effect also applies in the contrary where if the presence of a factor constrains ICT integration, then the absence of the same factor will be an enabler (e- Government, vol.3, 2005).

Enabling factors are those factors that are present or absent that promote ICT integration. The contributions of these factors that are the driving force always have a positive outcome in the successful pedagogical integration of ICTs. On the other hand, constraining factors hinder progress in ICT integration. They pose as barriers that contribute to the low levels of ICT pedagogical integration.

At this point, it is important to point out that the presence of a constraint can dominate an enabler and conversely the opposite applies. The presence and absence of both factors affect the level of ICT pedagogical integration in a school.

2.3.3 Progress in ICT integration

Several connotations can be applied to 'progress' in the context of this study. These are growth, advancement, improvement or development. Progress is a positive factor that allows for advancement from one level of ICT integration to the next. If constraints prevail, the progress is hindered, but prevalent enablers allow for successful progress to take place.

2.3.4 Ex-model C schools

Ex-Model C schools were the privileged schools during the apartheid era that consisted of 'White' learners. These schools had superior facilities, and they were well resourced and functioning efficiently and performed well in all aspects of schooling. A high level of parental involvement and support was noted from an affluent parent community. The school fees were much higher than other schools. As a result, the schools were able to hire and pay additional salaries for more teachers from the school governing body funds. The teacher- learner ratio was therefore, much lower than other public schools.

Although many ex-model C schools have become public schools in the post apartheid era, the standards that existed then still remain in some schools in terms of facilities (Roodt, 2011), infrastructure and demographics. These former schools are referred to as ex-model C schools.

2.4. Globalization

This section attempts to explain how the influence of globalization in the world education system has impacted on the South African education in the use of ICTs for teaching and learning. South Africa's education system motivation for the adoption of ICTs in the classroom in order to meet international standards is also discussed.

The early 21st century is commonly described as the era of globalization (Cloete & Badat, 2001). It has created a technological stir in the South African education system compelling South Africa to advance towards the information age. The contemporary society also expects the education

system to prepare learners for the workforce as it becomes more demanding in terms of ICT skills and competency levels. This has resulted in the growing interest in the infusion of information and communication technologies (ICTs) into classrooms by the South African government to integrate ICTs within the curriculum so as to promote ICT skills as well as the innovative use of ICTs for the creation of knowledge by learners. The attempt to integrate ICT in schools by the South African government is also a way to bring schools on board in this digital world (Prensky, 2001) where technologies revolve around us. It has been contended that successful integration of ICTs will offer a wide spectrum of valuable benefits for teaching and learning (Cope &Ward, 2002; Naidu, Cunnington & Jasen, 2002). In view of the global changing nature of the education system, it is important that the South African schools also participate in the information age by using ICTs to integrate content in the classroom in an attempt to meet international standards so that the citizenry can challenge or be equally challenged by the rest of the world.

From as early as the 1950's, the National Educational System (NES) has been influenced by the economic and social changes throughout the world. Although much has not changed within the classroom environment in many countries (computers are occasionally used in the classrooms but teaching methods and the curriculum have not changed much), globalization still has an effect on education and its practices (Carnoy & Rhoten, 2002). These changes that are taking place globally in education have put pressure on the South African education system, hence, the appeal and large investments by the South African government to work toward the successful implementation of the pedagogical integration of ICTs.

2.5. ICT policy in South Africa

Several changes in policy have taken place over time since 1995 from the establishment of the Technology Enhanced Learning Initiatives (TELI), which was followed by the feasibility study for the establishment of a dedicated educational channel. In 2001, the national DoE and the Department of Communication (DoC) jointly released a strategy for information and communication technology in education (Isaacs, 2007), which is believed to have laid the basis for the e-Education White Paper, adopted in 2004.

The South African ICT policy in education (e- Education White Paper, 2004) has undergone many changes in the past 16 years in an attempt to align ICT usage in schools with the rest of the world. The purpose of an ICT policy is to highlight the national vision in education that outlines the envisaged roles for teaching and learning. The contents of this research make reference to the White Paper on e- Education (2004) as this policy is the latest on ICTs in education. The role of the ICT in education policy is to establish a foundation for South African schools to facilitate pedagogical integration of ICTs. Although the goals for ICT usage in schools has been stipulated in this policy, many gaps still exist that constrain the implementation process. Many factors play a vital role in determining the success of the ICT integration outcome. These factors have been overlooked in the drafting of the ICT policy hence impacting on the realization of its goals.

2.5.1 ICT in education policy goals

The ICT in education policy goals (White Paper on e- Education, 2004) provide a basis for teachers to aspire toward achieving a national vision. Educational goals can be achieved through pedagogical integration of ICTs. However, advocating the ICT in education goals does not necessarily transform into successful implementation at ground level.

The ICT in education policy (White Paper on e-Education, 2004) has been largely influenced by the broader national government economic, social, and development strategy that has been evolving since 1996. The government has given much attention to the role of ICTs in schools in promoting economic growth, job creation, social development, and global competitiveness. In view of this, the DoE through the ICT in Education policy has expressed its support by advocating that: "Every South African learner in the general and further education and training bands will be ICT capable (that is, use ICTs confidently and creatively to help develop the skills and knowledge and to be full participants in a global community) by 2013" (DoE, 2003, 17). The proclamation made in the policy is a mere sweeping statement that sounds very attractive on paper but not that practical in reality. Much has to be done to improve the present state of South African schools before ICTs can be fully integrated. Unwin, (2004) cited in Hooker (2009) states that initiatives fail because much consideration is not given to the context in which they apply and often the notion of what suits one should suit all is applied. The goals stated in the ICT policy need to reconsider the South African contexts within which ICTs are situated and then develop schools based on a tailor made strategy that can help schools move to a higher level of

integration, hence the call to overhaul the gaps in the policy to improve on the implementation of ICT pedagogical integration. Goals play a very important role in the success of a project. It is essential that the ICT goal is clear in its definition for its aspiration or else there will be misconceptions regarding its implementation.

2.5.2 Challenges in the ICT policy

The researcher will engage in some aspects of the ICT policy (White Paper on e- Education, 2004) to highlight the challenges facing ICT integration within the policy.

Much effort has been put into the formulation of the ICT policy in order for schools to integrate ICTs. The initiative by the DoE in improving the ICT policy is commendable as it promotes ICT integration. However, several underlying factors that impact on the effective ICT integration process have been overlooked in the ICT policy. Some of these factors that may pose as constraints in this process are: 1. appropriate training for teachers. Many programmes "aim to develop specific skills of teachers, but which do not necessarily comply with professional standards of competency development" (Farrell & Isaacs, 2007:20; cited in Hooker, 2009). Many programmes are available to develop teachers professionally in ICT integration, however, they often lack comprehensiveness in the training, resulting in teachers being ICT literate but not equipped with sufficient technical or pedagogical skills to be able to integrate ICTs with the content (Unwin, 2004; Hooker, 2009; Isaacs, 2007). 2. Provision of explicit goals that are absent in the policy for schools to aspire towards, is a challenge because of the lack of clarity in the objectives. Schools are aware that they should integrate ICTs, but they are not aware of the purpose or gains (Mandinach, 2005; Shafika, 2006; Kirschner et al., 2008 in Hooker, 2009). 3. Schools are not given explicit guidelines in order to achieve the expected level of ICT integration. Hence, many schools are integrating ICTs at different levels (PanAfICT, 2008).

The ICT policy is inadequate because there are factors that contribute to the integration of ICTs at low levels that it has overlooked. The factors discussed above pertain to both challenges with the policy as well as in its implementation. Therefore, changes in the ICT policy ought to incorporate all these underlying factors for the effective implementation of the pedagogical integration of ICTs.

2.5.3 ICT policy implementation

The implementation of pedagogical integration of ICTs in schools has faced several constraints in South Africa (PanAf ICT, 2008) because of basic factors at ground level (Isaac, 2007). In order to overcome these constraints, policy designers need to refine the policy in considering physical factors affecting implementation at ground level (Moll & Ndlovu, 2009) as well as provide explicit guidelines for provisioning and safety of resources otherwise policy implementation becomes futile.

The ICT policy is a very important component in the implementation of the information and communication technology in education (ICTiE) process because it provides guidance for all stakeholders in the education system to follow. Unfortunately, the ICT policy does not provide much guidance with regards to steps that could be taken in order to achieve an acceptable level of ICT integration, resulting in varying interpretations and adoption (Strydom et al, 2005). Hence, it is extremely important that the ICT policy is clear in its expectations, especially in its definition of the terms "integration of ICT" that is to be adopted and implemented. The ICT policy provides the basis for implementation of ICT change. The interpretation of the term integration determines whether it is implemented successfully or not. The data on the ten schools in the PanAf research (2008) shows that ICT pedagogical integration is taking place at different levels in schools in different socio-economic backgrounds, whilst a few privileged schools are integrating at a high level. The rest of the schools are basically applying ICTs at a low level. It is therefore crucial that when ICT in education policies are designed, structures that enable their implementation in different contexts are available if any initiatives will succeed.

A draft ICT for Education implementation Plan, reports that, of the 25,582 public schools in South Africa, 5,778 have computers used for teaching and learning and 13,011 have one or more computer for administrative purposes (Isaac, 2007). Less than 5% of schools can afford internet connections and are integrating the internet for teaching, learning, communication, and collaboration. The report states further that in the absence of broadband connectivity, the quality of the use of ICTs for teaching and learning is low (Isaac, 2007). This serves to affirm the fact that in order to improve on the use of ICTs in the teaching and learning fraternity much has to be done in upgrading ICT infrastructure and organization in schools.

The provision of relevant, up to date ICT resources for effective integration is also vital because upgrading of ICTs can boost the effectiveness of ICT integration provided that all other necessary structures are in place. The responsibility in the provisioning of ICT resources then rests on the government (that issues the policy) to ensure that all schools are provided with ICTs and the necessary support to curb constraints in the integration process. In order for schools to successfully implement ICT integration, it is essential that clear guidelines in the ICT policy are present to provide schools with direction.

The presence of appropriate ICT structures is also important if ICTs are to be pedagogically integrated in schools. Proper guidelines at school level assist schools with the fundamental requirements for integrating ICTs. Guidelines and structures that are in place contribute to the achievement of high levels of ICT integration whereas the absence of these can constrain the process.

2.6 Factors at school level

Various factors affect the integration of ICTs at ground level. These factors pose as a driving force for ICT integration in its enablement or hindrance of the process. In order for ICT integration to take place at a high level these contextual or physical factors must be enablers. On the contrary, if the predominating factors are constraints, then integration takes place at a lower level. In this case, for the school to progress to the next level of integration it would have to overcome these factors. Some of the factors discussed in this section that either constrain or promote ICT integration are; leadership styles, time, and technical support.

2.6.1 The role of the leader in ICT integration

The principal, who is the leader should support the creation and articulation of a shared vision in ICT integration (Hughes & Zachariah, 2001), as well as harnesses commitment to improve teaching and learning through ICT integration (Haynes, 2007). This is an important factor in driving and managing change in the use of ICTs pedagogically. Good management is essential for the successful functioning of schools and for the purpose of this study in the effective integration of ICTs in the school.

Good leadership by the principal is one of the critical elements in the successful integration of ICTs in education (Haynes, 2007). The role of the leader is to champion the use of ICTs in such a way that ICTs are methodically integrated into the curriculum and mindsets of teachers (Brannigan, 2010). The leader's role is to provide opportunities for collaborative learning and knowledge sharing that can enhance the capacity of teachers by being able to explore and expand the dimensions in their teaching experience through the provision of resources, motivation, ongoing support (both technical and professional) and easy access (Ertmer, 2005). If the leader does not provide the necessary opportunities and support to teachers, this type of leadership can hinder the progress in ICT integration.

In order for the principal to manage the ICT process in the school, ICT training is vital for pedagogical integration to take place at a high level. Successful implementation of ICT pedagogical integration takes place through a thorough understanding of the ICT integration process. Cohen (2003) reported in a research on 21 schools in Gauteng, that the reason ICT projects are unsuccessful in schools is because the principals are often not informed about the value of using ICTs and this is what hinders their ability to manage the initiation of ICTs in their schools. It is for this reason that, the principals should have a comprehensive knowledge of ICT sfor integration to be enabled at a high level. Principals who are not well aware of the process of ICT integration are unable to contribute towards the integration process as well as in its advancement to the next level, thereby posing as a constraint.

Isaac (2007) states: "the absence of leadership and human resources to manage and support ICT programmes has proven to be a major constraining factor to the successful rollout on a province-wide scale." The leadership plays a very important role in steering the process of ICT integration in a school. The lack of support from the principal can slow down the progress in ICT integration, hence the low levels of ICT integration.

2.6.2 Time

Time is of essence for the enablement of ICT integration at a high level. Lack of time to give way to innovation in the use of these new technologies constrains the process, resulting in low levels of integration.

The planning of ICT integrative lessons requires much preparation time if these lessons are to be successfully executed. It involves time needed for research on the internet and soliciting advice on technology use like finding a suitable software or programme for the lesson, preparation of the lesson, integrating the lesson appropriately with ICTs, exploring and practicing the use of the ICT tools (Becta, 2004; Al- Alwani, 2005; Beggs, 2000; Schoepp, 2005 & Sicilia, 2005 cited in Bingimlas, 2009 & Jung, 2005). That accentuates the need for extra time as these integrative lessons take up more effort than traditional lessons (Sicilia, 2005 in Bingimlas, 2009).

Although the government has taken initiatives to promote ICT integration, teachers are not given the time to practice and explore the use of ICTs due to their work overload and commitments. Bingimlas (2009) reports recent studies indicate that although many teachers may have the ability to integrate ICTs, they contend that they do not have time to meet these expectations because integrating ICTs involves much more than just using the tools in the classroom. Sicilia (2005) also affirms in her study conducted in schools in Canada that teachers' constraints with regards to time is due to many class schedules which take up much time during their school day.

Teachers are under a lot of pressure. Due to the South African constantly changing education system, teachers are forced to constantly adopt and adapt new approaches to teaching (OBE, 2002; NCS, 2004; RNCS, 2005; CAPS, 2012). Furthermore, the concept of the pedagogical integration of ICTs (White Paper on e- Education, 2004) also has just been introduced to schools. The implementation and realization of these approaches to teaching require time for training, planning and implementation.

Lack of time, constrains the process of ICT integration whilst much time spent on planning and implementing of ICT integrative lessons promotes a high level of ICT integration. Therefore, in order for teachers to successfully implement ICT integration, more time should be given to teachers (Bingimlas, 2009; Mumtaz, 2000; Hennessy et al 2010 & Jung, 2005) to explore and expand their use of ICTs in the classrooms.

2.6.3 Technical support

Technical support refers to the installation, operation, and maintenance of technical equipment (including software), network administration, and network security. Technical support requirements of an institution depend ultimately on what and how technology is deployed and used. Without on-site technical support, much time and money may be lost due to technical breakdowns (Lim et al., 2003). The presence of technical support specialists in schools is essential for the continued viability of the ICT integration process within the school.

Mumtaz (2000) contends that schools that integrate ICTs at a low level are perceived to perpetuate ongoing ICT problems due to the lack of technical support. Schools should have at least one technical assistant on-site to provide ongoing technical support and development. The presence of technical assistance contributes towards the enablement of ICT integration at higher levels because teachers that are technophobic can use the ICT without fear of experiencing technical failures in their lesson (Bingimlas, 2009; Mumtaz, 2000).

Schools that have technical support integrate ICTs at high levels (PanAfICT, 2008). Lack of technical support hinders the progress of ICT integration.

2.6.4 Professional development of teachers

Professional development should be at the forefront in training teachers to integrate ICT effectively in the classroom by the government if integration of ICTs is to be enabled. Professional development in the context of this study refers to the appropriateness of the type of training received by teachers on ICT integration. Teachers that are trained in basic ICT skills (computer literacy) are not sufficiently equipped to integrate ICT in their classrooms (Bingimlas, 2009). Although being computer literate is an enabler, it becomes a constraint because the ICT skills acquired by the teachers only promote low levels of integration, thus hindering progress to the next level.

2.6.4.1 ICT capacity building

For ICT integration to take place at a high level, capacity building of teachers is essential in the use of ICTs in their pedagogical practices to enhance their teaching in the classrooms. Capacity building entails intensive ICT skills (pedagogical integration of ICT that promote active learning), knowledge development in improving competencies and training of teachers to develop ICT lessons through the use of resources available (UNESCO, 2003). The process of ICT integration cannot take place if teachers are not trained with the necessary skills to implement this process. Lack of or poor capacity building of teachers is a constraint and results in low levels of ICT integration, while rich capacity building of teachers enables a high level of ICT integration.

Building of capacities is necessary if teachers are to integrate ICT at a high level. Hennessy et al. (2010) states: "The successful integration of ICT into the classroom depends on the ability of teachers to structure their learning environments in non-traditional ways, merging technology with new pedagogies. This requires a very different set of classroom management skills to be developed, together with innovative ways of using technology to enhance learning and encourage technology literacy, knowledge deepening and knowledge creation." The enablement of pedagogical integration of ICTs in the classroom can take place with the acquisition of intense ICT skills development of teachers that requires much innovative and creative planning and preparation. Poor quality of capacity building hinders the process and stagnates progress.

Although South African government's initiatives to promote teacher ICT capacities do take place, the training received by the teachers seems to be inadequate to promote a high level of ICT integration.

2.6.4.2 Ongoing appropriate training

Due to the changing nature of the technologies and software, ongoing appropriate training must take place to keep up with the changes and to be trained and guided in the creation of digital content. The Guidelines for Teachers Training and Professional Development in ICT (2007) states: "Teacher development should be ongoing, due to the changing nature of ICTs. Programmes should reflect new technologies and applications". The enablement or constraint of

the ICT integration is determined by the type of training received and by how often teachers attend appropriate developmental workshops on ICTs. The term 'appropriate' can be determined by the achievement of the goals set out for ICT integration (UNESCO , 2008) and The Guidelines for Teachers Training and Professional Development in ICT (2007) sets out standards for competencies. If the teacher is able to achieve these objectives from the training received, then the training is appropriate.

Appropriateness depends on the teachers application of ICTs through evaluating, integrating, communicating data, presenting, designing and inventing new data, creation of knowledge, collaborating the use of ICTs effectively, problem solving and promotion of advanced cognitive skills amongst many other ICT skills (Guidelines for Teachers Training and Professional Development in ICT 2007; UNESCO 2008; Gichoya, 2005; Hennessy, 2010). These skills are acquired through intensive and ongoing training which enable ICT integration at a high level if applied by teachers in their teaching. A lack of intensive ICT skills training may constrain ICT integration.

The White paper on e-Education (2004) emphasises that all teachers will be trained in the effective use of ICT. Projects such as School net, and The Intel, launched in 2003 in S.A, Teach to the future were aimed at helping teachers integrate technology into the classrooms as they implemented the Curriculum 2005 and RNCS, (Strydom & Thomson, 2005). The programme consisted of ten comprehensively designed modules which had focussed on the integration of ICTs into the curriculum. The teachers had used their own work schedules to create assessments and rubrics for the assessments. The sessions were hands-on and teachers were given an opportunity to work in teams using the problem solving approach. The tasks that were set had suited their own contexts which they could easily relate to (Strydom & Thomson, 2005). Such tailored ICT training enables the implementation of positive ICT integration at high levels because the training addresses the specific needs of the teachers.

Although there have been a few initiatives to develop teachers professionally, the training provided now has not been intensive enough to address the need that enables integration of ICTs at high levels. Problems such as general workshops (one size fits all) for all teachers, short sessions often limited to one or two days, prescribed programmes by Gauteng on Line (GoL) and

the focus on computer literacy rather than intense ICT skills are encompassed in these trainings (Bingimlas, 2009; Strydom and Thomson, 2005). Furthermore, the training is not on-going, resulting in teachers lagging behind in the process. Hosman,(2011) contends that teacher ICT training cannot be once off, instead it should be ongoing for the sake of progress. The inappropriateness of the present training and limited training is a constraint to the integration of ICTs. Therefore, for higher levels of ICT integration to be implemented, the training provided must be appropriate and on-going.

2.6.4.3 Type of training

The type of training either enables or constrains ICT integration. ICT skills differ in their nature of application. Computer literacy is an ICT skill that provides basic knowledge and application in the use of Word, Excel, PowerPoint and internet (Bingimlas, 2009; Ndlovu, 2011); the use of this skill enables planning out of the classroom. This skill enables ICT integration at a low level. ICT intensive skill or technological skills (Ndlovu, 2011) refers to those skills that enable a teacher to create and design lessons that promote active learning and construction of knowledge in the classroom. Intensive ICT skills training promote integration at higher levels whilst the absence of appropriate and continuous training hinders progress and integration takes place at a lower level.

Much of these training sessions were conducted in the earlier years but have not been sustained due to lack of resources and infrastructure (Strydom & Thomson, 2005). This has impacted immensely on the integration process because the lack of appropriate training results in low levels of integration. The present training offered equips teachers with basic computer literacy but without any technical skills to integrate ICT in the curriculum (Ndlovu, 2011).

Training and development needs to be constantly upgraded as new technologies are introduced so that teachers can apply their ICT skills appropriately in integrating the tools in their practice. A few hours of training in the use of ICTs is insufficient to develop teachers adequately to use them creatively in teaching. Creativity and innovation in ICTs require technical skills in the use of ICT tools for integration. A person that is not trained in the use of ICTs for integrative purposes may be challenged with its use. Therefore, training and development for teachers must be well structured and intensive (UNESCO, 2008; Guidelines for Teacher Training and

Professional Development, 2007). In order for ICT integration to be enabled at a high level, the training should cater for planning using ICT resources innovatively in context to facilitate lessons that promote construction of knowledge by learners.

It is through training and development that progress is made in the levels of ICT integration. Bingimlas (2009) and Wilson & Strydom (2005) describe different skills that teachers need to acquire in order to fully integrate ICTs such as being trained in pedagogical issues and in using ICTs effectively to integrate ICTs in the curriculum and ICT basic application skills. The basic computer literacy (Word, PowerPoint, Excel, and internet) does not provide sufficient ICT skills that enable the competence to integrate ICTs. Instead, more integrative skills are required.

Teachers should also be trained technically, at least at a basic level, on the use of the various ICT equipments because they need to know how to operate the ICT to avoid unnecessary lesson disruptions in case something technical goes wrong.

2.6.4.4 Change in attitude and behavior

One of the biggest challenges facing ICT integration is the inconsistency in the integration due to the differences in teachers' attitudes towards this process. The attitude of teachers towards the pedagogical integration of ICTs may pose as a challenge due to varying levels of ICT competence (Sanber, 2007). These play an important role in the enablement and constraint of this process.

Developing ICT policies and bringing computers into the classroom does not necessarily influence the integration of ICTs; it is the mindsets of the teachers that have to be changed to embrace this new mode of teaching (Troure et al., 2008). Ultimately, a change in mindset brings about positive change in behavior; if the implementers of this process are not willing to change their teaching methods, very little or no progress can be made in the integration of ICTs.

Changes in behavior result from experience that involves learning. It would seem fair to expect that if one is to say that learning has taken place, experience should have taken place in some way. Banks et al. (1999) contend that teachers' attitudes are influenced by their confidence in the use of ICTs. Integrating ICTs in teaching and learning is not an easy task for educators; it is a process that involves much practice, training and constant development. Teachers can only apply

their practices in their teaching if they understand what and how to do so. It is also through their training and experiences in the use of ICTs that they implement this process and use it interactively at a high level. This change in behavior can only be possible if teachers are appropriately trained in the field of ICTs so that they are in a position to execute their skills acquired through the training received. Govender et al (2010) reports in a survey conducted in KwaZuluNatal that many teachers have positive attitudes towards the use of ICTs; however, many teachers lack the basic skills to integrate ICTs in the classrooms, whilst other teachers lack the proficiency to use ICTs in the classroom. If the development received by teachers is useful, then teachers' behavior or attitudes towards the implementation of ICT integration would be an enablement, but if the training received is inadequate for ICT integration, then the teacher's behavior would not favor the process and therefore becomes a constraint.

Change in behavior can enable ICT integration if teachers are exposed to the benefits of using ICTs. Often the benefits of ICT integrative lessons are not emphasized enough resulting in the low integration of ICTs. Although the White Paper on e-Education (2004); Guidelines for Teacher Training and Professional Development (2007) and UNESCO (2008) highlight the value of ICT integration in the classroom, teachers' behavior in the classroom do not reflect the importance of these gadgets and as a result the integration of ICTs is still at a low level in most schools in South Africa (PanAf, 2008; Govender et al., 2010).

Technophobia, which refers to the fear of using technologies in the classroom for teaching and learning, also contributes to the low ICT pedagogical integration levels (Bingimlas, 2009 and Mumtaz, 2000) because teachers are afraid to utilize these tools either because they don't know how to use them or are afraid of technical problems. Teachers can overcome this fear by the frequent use of ICTs. The absence of ICT resources, or technical assistance, both contribute to the constraint in the integration process for teachers who are unable to use the equipment.

Teachers' attitudes towards ICT integration can enable the process if they are adequately trained to use ICTs, are aware of the value of ICT integration in the class and are able to use ICTs confidently. Teachers' attitudes can be changed from a constraint to an enablement to make provision for ICT integration at a high level.

2.6.5 Availability of resources

It is crucial that when ICT in education policies are designed, resources should be available to enable the implementation of ICT integration if any initiatives will succeed (Bingimlas, 2009).

This serves to affirm the fact that in order to improve on the use of ICT in the teaching and learning fraternity, much has to be done in upgrading schools and provisioning of relevant ICT resources for effective integration. The responsibility in the provisioning of ICT resources then rests on the government and its different sectors to ensure that all schools are provided with ICTs and the necessary support to curb constraints in the integration process, otherwise policy implementation becomes futile (Ndlovu, 2011)

The presence of ICTs in a school does not necessarily imply that ICT integration is taking place. Although many schools have ICTs, these are insufficient to cater for the large classrooms in South African schools. Chigona (2010) reports that limited resources affect the use of ICTs for teaching. The pedagogical integration of ICTs at high levels depend on the availability of adequate resources in order to promote interactive learning because: "A high learner to computer ratio results in less exposure to the computer per learner and may result in one learner dominating the use of a computer while the others simply watch passively" (Chigona, 2010, p.4). Adequacy of resources ultimately affects ICT pedagogical integration. Therefore, for schools to be successfully integrating ICTs at a high level, it is essential for sufficient ICT resources to be available. The availability of resources has impacted immensely on the implementation of pedagogical integration of ICTs in schools. The issue of resources is one of several constraints facing most South African public schools (PanAf ICT, 2008; Isaac, 2007).

2.6.6 Accessibility

The issue of accessibility is very important if ICT pedagogical integration is to be successfully implemented in schools. There are various forms of accessibility that operate within a school. These include access to ICT resources, access to the internet, access to technical assistance and access to the ICT policy (Bingimlas, 2009). All of these affect the integration of ICTs. Although the lack of access may constrain ICT integration, accessibility does not necessarily enable ICT integration (Bingimlas, 2009; Strydom & Wilson, 2005).

According to Strydom and Wilson (2005) schools that had full access to implement ICT integration did not integrate ICTs and, therefore, access does not influence ICT integration. The implication is that accessibility is dependable on other underlying factors that impact on integration. These depend on the adequate availability of resources. Bingimlas (2009) also contends that the inaccessibility of resources is caused by the presence of a few computers that have to be shared by teachers and, due to this; the resources are not always available. Therefore accessibility plays an important role in ICT integration, and is a dependable variable.

2.7. Conclusion

Although countries are at the beginning of using the new technology, its future use in education cannot be underestimated (Carnoy & Rhoten, 2002). It is assumed that ICTs brings revolutionary change in teaching methodologies. The innovation lies not, per se, in the introduction and use of ICTs, but in its role as a contributor towards a student-centered form of teaching and learning.

Scrimshaw, (2004) and John and Sutherland (2005) warn of speaking of the affordances of new technologies with the assumption that a given medium or technology will automatically afford particular learning outcomes. A good teaching practice is not derived from what tools are used to teach but how they have been used to bring forth the knowledge intended to deliver. In using the ICTs effectively in teaching and learning, it is essential for educators to be fully trained and equipped with the knowledge and experience of using ICTs to integrate the curriculum (Ali et al., 2009). The process of ICT integration involves much planning, training, funding, infrastructure, time, commitment and ongoing support and development for notable progress to be made. The government also has to review policies in light of what is presently happening in schools and revisit the gaps in the policy, to address the challenges facing South African schools. Changes are gradual and are influenced by underlying contextual factors that affect progress (Christie, 1996; Ertmer, 2005Marshall et al, 2007; Chigona, 2010;).

Although the government has taken some initiatives to improve on the pedagogical integration of ICTs in schools by developing infrastructure to accommodate change and by increasing enrolments in ICT fields of study in providing bursaries for ICT education or e-Learning courses, the constraints faced in ICT integration seem to overwhelm these initiatives.

Chapter 3: Research Design and Method

This research methodology is mainly a qualitative case study with some elements of quantitative analysis. Cresswell and Plano Clark (2007: 67) in Mcmillan and Schumacher (2010:396) state that this type of case study is referred to as the embedded design because: "one data set provides a supportive secondary role, in a study based primarily on the other data type." This method is used because a single design method is inadequate to respond to the research questions, therefore, the one method supplements the other, hence, complementing each other to enable a comprehensive presentation of the study undertaken. The researcher had used the data collected from the teachers and the principal (interviews/ questionnaires) in the school under study as the primary data and this was supplemented by the data collected on this particular school that is present in the PanAfICT observatory as secondary. Therefore, this is a mixed mode type of study.

This is a phenomenological case study as described by Mcmillan and Schumacher (2010) because it reflects "lived experiences." The teachers' experiences on their use of ICTs and the factors that constrain or enable the integration of ICTs within this school are expressed by the teachers. The stakeholders (teachers and the principal) perspectives of these experiences are reflected and analyzed by the researcher, hence, the descriptive approach that provides the views and experiences of the teachers' use of ICTs.

All 33 teachers including the principal at the school had completed questionnaires, semi-structured interviews were held with four teachers (one teacher from each phase as well as the ICT teacher) and the principal. An informal school visit was also made to view the ICT facility and infrastructure available at the school. The interviews that were conducted were transcribed (pen on paper) and later typed on Word (at home). In order to provide a valid and reliable presentation, the data gathered were triangulated. Triangulation is described by Kelly in Terre'Blanche et al. (2009: 380) as "the use of multiple perspectives against which to check one's own position." The researcher has applied various ways of cross checking the data by triangulating the data collected hence checking the authenticity of the declaration.

The content in this section contains; firstly, the research design used and addresses the procedure for empirical investigation that is channeled by the research question (i.e. the factors that enable

or constrain the pedagogical integration of ICTs in a South African school),secondly, the reason for the choice of the case study approach, thirdly, details of the participants and the setting and the selection and implementation of appropriate tools, fourthly, the issues of validity and reliability as well as the limitations of the research methodology and the ethical considerations are also discussed in this chapter, and finally, an explanation of the data analysis methods in verifying the findings.

3.1 Research design

Mixed method approach

The research design used in this case study adopts the mixed method approach by using both qualitative exploration (McMillan & Schumacher, 2010) and is elaborated by quantitative data. The use of a mixed method approach was adopted in a pragmatic effort to identify how various factors influence the extent to which ICT is pedagogically integrated in this school. The qualitative exploratory method is defined as an empirical inquiry that investigates a contemporary phenomenon within the context of a real life experience. In this case, the experiences and views of the teachers and the principal of the school that addressed the research question was considered by the researcher in using the data collected from the questionnaires and the semi- structured interviews. The correlation of both the qualitative (interviews) and quantitative (questionnaires) data assisted the researcher to understand an overall depiction of the phenomenon.

Whilst the quantitative approach assisted with data that was statistically presented and analyzed, the degree at which ICTs were integrated at this school was emphasized. The quantitative representation of the data was completed using both the questionnaires as well as the data from the interviews. In this study, the findings regarding the number of teachers integrating ICTs, the use of ICTs within the school, the ratio of ICTs to the teachers and learners, and the availability of ICT resources were statistically represented. Given that the researcher detached herself from the object of study (De Vos, 1998), the data represented quantitatively is an objective inquiry.

Qualitative method

Qualitative research is defined by (Cresswell, 2007: 37 in McMillan & Schumacher, 2010):

> *"Qualitative research begins with assumptions, a worldview, the possible use of a theoretical lens, and the study of research problems inquiring into the meaning individuals or groups ascribe to a social or human problem. To study this problem, qualitative researchers use an emerging qualitative approach to inquiry, the collection of data in a nature setting sensitive to the people and places under study, and data analysis that is inductive and establishes patterns or themes. The final written report or presentation includes the voices of participants, the reflectivity of the researcher, and a complex description and interpretation of the problem."*

The researcher had selected the qualitative research method because this study was undertaken in a natural setting (a school) that was context sensitive. This qualitative study was undertaken within the context of the educators operating ICT resources in which an examination of the factors that influenced their use of the ICTs in pedagogy was conducted in their school. The teachers' and the principal's views were considered together with the researcher's reflection based on the context, literature and the PanAfICT (2008) database. Direct data collection from the source, namely; teachers and the principal through questionnaires and interviews and complex understanding and explanation of the situation had taken place with multiple perspectives from the different teachers and the principal (McMillan & Schumacher, 2010).

Quantitative method

The techniques used in quantitative research design enables the researcher to collect data in the form of numbers and use various statistical types of data analysis (Durhheim in Terre'Blanche et al., 2009). The researcher had used the data from the questionnaires to highlight certain aspects of the research which had emphasized some of the main factors that influenced the pedagogical integration of ICTs at this school. These included data on type of ICTs usage, the number of teachers that were integrating ICTs in their teaching as well as the frequency of ICT use. The

data was represented in the form of tables and graph. These statistics helped to enrich the research and also provides an explicit data representation.

Case study

The reason the researcher has selected the case study method is to help give a detailed account of why this particular well resourced school has not made progress in its implementation of ICT pedagogical integration. Michael Fullan (2001) emphasizes the importance of giving attention to specific contexts. He suggests that 25% of implementing change in education should be spent on guidance and 75% on figuring out how to implement it in a specific context. Data from PanAfICT (2008) on this school shows that resources and paper work exist, a case study was ideal to determine what unique features in this school are responsible for ICT pedagogical integration level and its failure to make progress in its use of ICT.

This is a contextualized research that reveals the reality of ICT integration at the school as well as the views and experiences of some stakeholders (teachers and the principal) regarding the pedagogical integration of ICTs is emphasized.

Exploratory study

The exploratory method was used to consolidate both the qualitative and quantitative data collected. The data from the participants determined a relationship (McMillan & Schumacher, 2010) which had assisted in strengthening the case study in investigating and gaining new insights and a better understanding of the research phenomenon (ICT integration environment).

Descriptive study

A descriptive study aims to describe a phenomenon accurately through various ways such as narrative, classification or by measuring relationships (Durrheim in Terre'Blanche et al., 2009). The researcher has systematically and as accurately as possible formulated a rich description of the phenomenon by capturing the interface experience of the participants in this school through interviews and a general observation of the ICT context within the school without any manipulation of the data.

3.1.1 Data Collection Schedule

The researcher made five visits to the school during the process of data collection. The first visit was made earlier in the year to meet with the principal and ICT teacher in order to gain their consent to carry out this research at the school. The researcher then re-visited the school to meet with all the participants to inform them of the rationale for this research. Consent forms were then handed to all present. The consent forms were completed by all the participants and were returned to the researcher on the same day. The next visit by the researcher was made around mid year. The researcher had met with the ICT teacher; an informal visit was made to the specific venues with ICT presence; and the ICT teacher was then given the questionnaires which were to be distributed to all the participants. The questionnaires were then collected after two weeks. Once the researcher had reviewed all the questionnaires and had realized that there was a need to interview a sample of participants, the last visit was made to the school in order to interview the selected participants (September). The researcher intended to go back to the school to provide the participants with a feedback from the research; however this was not permissible because all the participants at the school were very busy with the end of year preparations.

Communication between the researcher and the ICT teacher was frequent throughout the year for various purposes such as for consents, making prior arrangements to meet at an appropriate time, interview schedules and for the informal visit to the computer lab as well as the media center.

3.1.2. Setting

This research is a minute study that is conducted at one ex-model c primary school in South Africa. This school is part of the bigger research project that was investigated by the research agenda on the pedagogical integration of ICTs in educational institutions (2008). The purpose of selecting this particular school is because this school is well resourced with ICT (PanAfICT, 2008) and the researcher was keen to know whether the presence of a range of ICTs promotes ICT integration. Hence, identifying the enablers and constraints in the pedagogical ICT integration and establish the level at which ICTs are integrated pedagogically. This school is a high achieving academic institution, located in the far Northwestern suburbs of Johannesburg, in an upper middle class community. There are 33 educators in the institution and 969 learners in total. This school has 54 computers in total and all 54 computers are connected to the internet. Of

the 54 computers, 7 computers are available for educators and 44 for the learners, the rest are used by the admin staff.

3.1.3. The participants

Sampling

The sample for this research was selected from 10 schools participating in the South African PanAfICT(2008) research project database. Sampling refers to the selection of research participants from an entire population that entails decisions regarding which group of people, settings, procedures or processes to observe (Durrheim in Terre'Blanche, 2010). The representativeness is an issue of concern with regard to sampling because when the researcher makes a conclusion it is necessary for a sample to be selected that will be representative of the population, especially in descriptive surveys in accurately estimating the properties of the population. This school represents schools in South Africa that are well resourced with digital equipment, yet are not maximizing the use of these technologies in the classroom. Secondly, the size of the sample can be problematic for unrepresentative sampling whereby the sample is small and random. The selection of this school was not random. A review of the 5 public primary schools in the project was done to see if there were similarities in their pedagogical integration. This school was the only school of the 5 that had a wide range of digital technology and yet its use of ICT was at a low level. It is essential that the researcher selects a sample that reflects the characteristics of the population that is relevant to the study; otherwise the process will be futile (McMillan & Schumacher, 2010). The research sought to understand why well resourced schools integrate ICT at a low level and to know what is hindering their progress.

In order to overcome any challenges facing sampling and for more accurate inferences, the selection of samples was large for accuracy, All teachers in the school (33), including the principal as a manager participated in the research. For the purpose of gaining more data on this study the researcher selected the stratified purposive sampling. McMillan and Schumacher (2010) describe the type of sampling as "the quantitative approach of stratifying the population is followed by purposive selection of a small number of cases from each stratum that are studied intensely." Furthermore, four teachers were interviewed individually (one from each phase, which is one foundation phase, one intermediate phase, one senior phase and the teacher in the

computer laboratory). The intention for the selection of interviewees was to get an overall, in-depth feel of the situation; details of their understanding of ICT pedagogical integration and how they applied it in their phases. A combination of teachers from each phase who were integrating and those who were not, were going to be selected, but unfortunately that did not happen because the research could only interview teachers who were available.

3.1.4. Research instruments

Data for this study was collected from three main sources through the use of:

Questionnaires (Appendix)

All the teachers and the principal were handed a copy of the questionnaire to be completed and submitted after 2 weeks. A questionnaire was a convenient method to use to collect data in the form of a survey without the researcher being present. The questionnaire used was adapted from the same instrument that was used in the PanAfICT, 2008 so that progress could easily be identified, if any, since the last research and for relevance to this research. They consisted of both structured (closed) and semi-structured (open ended).The questionnaire in Appendix 7.1 & 7.3 provided relative answers for this particular study. All teachers (100%) completed the questionnaire, but the responses were too precise to give the researcher adequate detail to make a valid conclusion on the study. This was due to the poor timing of the data collection.

Interviews (Appendix 7.2 & 7.4)

Four teachers from each phase were interviewed; that is, foundation, intermediate, senior and the ICT teacher (to find out which activities the learners were engaged in during their computer lessons). Semi-structured questions were used for the interview to allow the researcher to prompt the teacher being interviewed to elaborate on the data being shared. In the interviews, the interpretive approach as claimed by Terre'Blanche (2009) was used to make sense of their practice through interacting with them in their environment.

Database: The PanAfICT (www.observatoiretic.org) database

The observatory with data from 10 South African schools collected in 2008. (This school was one of the schools participating in the research.

3.2. Data analysis

The data base from the PanAfICT (2008) was used as a source (empirical evidence) to compare the data collected in 2008 against the current data which was presented as the pre-data findings. The researcher had reviewed the responses from the questionnaires and the interviews. Common themes were identified from the responses which were used in the discussion of factors influencing the integration at this school. The school was then placed at the level of ICT integration, based on its enabling and constraining factors. Reference was made to the UNESCO levels in the discussion of the factors that would promote progress in this school. Literature was also used to establish the position the researcher took in determining the factors. After establishing that this school had not made significant progress in its integration process, recommendations to improve on the present level were suggested for the school in order to advance to the next level.

3.3 Validity

The reliability and validity of this case study is strong because the context is weighed against theory that has already been tested .The results of the findings can also be compared to other contexts to validate the data. Since validity refers to: "the degree to which the research conclusions are sound" (Riet & Durrheim et al. in Terre'Blanche et al. (2009 : 90) the conclusions made are reliable based on the empirical evidences. In this case, the researcher had carefully adapted the original PanAfICT (2008) questionnaires and interview instruments, ensuring that the questions in both the instruments corresponded with each other in such a way that the responses overlapped. The responses were then triangulated to authenticate the data.

3.4 Ethics consideration

The consideration of ethics helps in protecting the respondents by preventing them from harm and by reducing adverse consequences for the researcher (Wassenaar, in Terre'Blanche et al., 2009). The non- disclosure and confidentiality of the teachers as well as the principal and the school was prioritized. The Gauteng department of education gave permission for the

undertaking of this study at this school as well as Wits University (consent letters attached-appendix 7.6). Initially an introductory letter was sent to the principal of the school informing him of the details of this study. On receiving an approval letter from the school, consent forms were handed in and sought from the respective participants for the interviews (Appendix 7.5).

3.5 Limitations of the study

This study was conducted in one South African public school which is a minute study limiting the occurrences with regards to pedagogical integration of ICTs in other schools within the country. The factors influencing ICT integration in this particular school may not necessarily reflect what is happening in other schools. Secondly, although all teachers as well as the principal have completed the questionnaires, there is no guarantee that either the teachers or the principal were objective in their completion of the questionnaires. The questionnaires were not completed in detail as it was the incorrect time of the year.

The ICT teacher was not very supportive in assisting the researcher with the specific sample requested and, therefore, the researcher had to work with the participants that were selected by the ICT teacher. The researcher experienced much difficulty in communicating with the school. The teacher had indicated that teachers were not available for the interviews as they had no time. Therefore, only 4 teachers were arranged to be interviewed along with the principal.

The questionnaires completed by the teachers indicated their non interest in assisting with this study as the questionnaires were not completed in detail, although the main aspects of the study were sufficiently answered.

Chapter 4: Data Findings and Analysis

4.1 Introduction

The purpose of this study was to investigate the factors that enable or constrain the pedagogical integration of ICTs in a South African primary school and use them to determine the integration level of the school. The results of the data collected is presented and analysed in this chapter.

In assessing the level at which this school is integrating ICTs, the researcher has used the UNESCO levels of integration model (2002) to place the school at a specific level based on the enabling and constraining factors presented. The research question used for this study is as follows:

What enabling and constraining factors in this school, determine its level of ICT pedagogical integration and its progression?

Sub-questions:

1. *What factors influence the ICT pedagogical integration in this school?*
2. *What is the level of pedagogical integration of ICTs at this school (based on the enabling and constraining factors)?*
3. *What factors are likely to promote progression of ICT integration in this school?*
4. *What factors disable progression of ICT integration in this school?*

It is important to note that this study is not focused on the comparison of data over the past 3 years, but on trying to understand why there has not been any progress in the ICT pedagogical integration of this school. The first presentation and analysis of data will, therefore, present a table that confirms this initial finding. Furthermore this chapter focuses on the factors to establish whether they enable or disable ICT pedagogical integration. At that stage the researcher will be in a position to determine the position this school takes on the UNESCO model. Thereafter, a discussion on the capacity of these factors to promote ICT pedagogical integration progression will ensue.

4.2 Pre-data findings

The researcher selected factors that are and should be enabling ICT pedagogical integration in this school and used them to examine if there was any indication that progress was made by this school in its technology use. Some of these are indicators used in the PanAfICT database (Indicator 4 and 7) and have been modified to address issues that will assist in looking closer at the elements that should influence progression in the use of ICTs for teaching and learning in this school.

Description of Factor	Data for 2008	Data for 2011
Principal's perception on impact of ICT integration into the curriculum	Principal: "Not great, but staff are generally interested in acquiring the skills. Almost all have mastered the basic skills but more on administrative and lesson preparation levels. ICT use in classrooms is limited." 07/09/08	He mentioned that teachers are not integrating ICTs because they don't have adequate resources, time and technical support and mostly the training received by teachers is not intensive enough for ICT integration. 24/08/11
Number of computer labs	1	1
Number of computers available for use for teaching and learning	44 (learners) 7 (educators)	44 (learners) 7 (educators)
Other ICTs available for use for teaching and learning	Not noted	Yes- 3 data projectors and lap tops; 1 SMARTBOARD
Software used for teaching and learning	MS Windows & Microsoft Office suite (Word, Excel, PowerPoint, Maths and English story, ELA	MS Windows & Microsoft Office suite (Word, Excel, PowerPoint, Maths and English programme and ELA, KDA
Courses taught using ICT	The school principal indicates that, while all 9 learning areas are taught using ICT to some extent, "the degree of integration is relatively small"	"Teachers are not obligated to use ICT.". Teachers are only using ICTs for administration purposes.
Teacher Training: frequency, relevance and duration	All 33 teachers attended more than 50 hours of training- on computer basic skills. All educators in the school are computer literate and they are able to prepare and present lessons using ICT	33 teachers attended short courses- internal workshop to orient them to new technologies whenever they come. "Only 20% of the teachers use the ICT resources available and in an average of thrice in the year for PowerPoint presentations.
Technical support during lesson presentations	Yes	None
ICT use for teaching	Mainly Word for planning, Excel for marks, internet for research, weekly template, ELA programme, Maths and English story	Mainly Word for planning, Excel for marks, internet for research, PowerPoint, weekly lesson plan template, ELA programme, Maths and English

Table 4.1: Initial data findings

It is evident that there is minimum impact of factors in the use of ICTs by teachers in the classroom and, therefore, there is insignificant progression, despite the fact that new technologies (lap tops, SMARTBOARD and KDA software for physical Education fitness programme) were introduced in 2011. The principal has been aware of the low integration levels in this school for the past 3 years. His focus has been in acquiring the latest technologies like the SMARTBOARD, data projectors and laptops and not maximizing the use of the resources

available. It seems there has not been an initiative to improve on the level of integration in the school. ICTs are still mainly used for administrative purposes and not for presenting lessons in this school. Another notable factor is that there is no technical assistance available during lessons presently, whereas in 2008 it was there. Minimal use of ICTs by teachers could be the reason why the service of a technical assistant was withdrawn. Lewis (2003) emphasizes the need for technical support particularly for ICT use in the classroom. Teachers in this school have no option but only to use basic computer skills for lesson preparation as usage in the classroom could be disrupted if they encounter technical problems.

Focus now will be on the factors influencing pedagogical integration in this school to establish whether they enable or disable ICT pedagogical integration. When that is established, the researcher will be in a position to determine the position this school takes on the UNESCO model. A discussion on the capacity of these factors to promote ICT pedagogical integration progression will thereafter follow.

4.3 Factors influencing the pedagogical integration of ICTs

The factors that influence the pedagogical integration of ICTs have an immense impact on the level of pedagogical integration of ICTs. The following section discusses the various factors that have emerged as pertinent to the implementation of ICT integration in the questionnaires as well as in the interviews. The researcher addresses these points by presenting the findings and then determining whether they are enabling or constraining.

4. 3.1 The role of the leader in managing ICT integration

The principal in this school plays the role of a leader. There is a head of department in charge of ICTs, but her influence on the actual integration of ICTs is minimal. She is mainly accountable for the daily errands involving technology usage. The principal is supposed to lead the implementation process of ICT pedagogical integration in this school. Literature covered in this research describes the leader's role in the integration process as that of 'managing, driving and championing' this transformation (Brannigan, 2010). His remarks, attitude, organizational style and actions confirm the enormity of his role in the state at which the school is integrating ICT pedagogically.

4.3.1.1 Creating an ICT environment

The principal has prioritized providing the school with physical resources as the basis for giving ICT access to the learners and teachers. In an interview he says: *"In view of the fact that we are surrounded by technology out there and schools are expected to use computers, we have made every endeavor to ensure that our school is equipped with computers. Since our school fees are low, we had appealed to the SGB to assist us."*

He expressed contentment with the fact that the school had sufficient ICT resources (desk top computers, lap tops, SMART BOARD, computer laboratory, and internet) in place and this, he believes, is a positive factor to the use of technology in his school. It is not clear to what extent he expects teachers to use technology; whether for lesson preparation or for teaching. The principal seems to think that by providing ICTs to teachers and making ICTs easily accessible, he has provided an environment conducive for ICT usage; 'how', seems to be immaterial to him and yet that determines the school's effectiveness in preparing learners to be meaningful participants in our society that is 'surrounded by technology' as he says.

The principal's role in advocating change and creating environments conducive for ICT teaching and learning is missing in this school and yet it is an important ingredient for ICT integration (Haynes, 2007; Kearney & McGarr, 2009; Kirkland & Sutch, 2009). For effective pedagogical change to take place in an organization, the leader should ensure that appropriate structures are in place for implementation to be successfully executed. The provisioning of ICT resources is not sufficient. The process needs to be 'driven.' The fact that the principal admits that teachers do not really use ICTs in the classrooms but utilize them mostly for administration purposes, and does not express concern over that, is a factor that constrains progression in ICT integration.

He further stated that *"Teachers are not obligated to use ICT* and that the "*ICTs are present for teachers' convenience if they prefer to use them"* and yet usage is not a requirement. He also said that many teachers especially the older teachers in the school do not prefer to use ICT for teaching and that did not bother him because they *"they are doing a good job"* especially the older teachers. The culture he seems to be inculcating is that which allows freedom of choice at the expense of ICT

pedagogical integration. It is his obligation as the school leader to create a culture and structures that leave all teachers with no option but to integrate ICTs into the curriculum if progression is to happen. Louis, Kruse and Marks (1996) point out that the principal is in the best position to deal with structural changes to support learning. In this case, the principal might be having these structures that support learning, but his lack of initiative to lure teachers into using ICT makes the teaching in this school productive and yet irrelevant to the urgent needs of today's information society.

The principal's plea for more resources to the School Governing Body could just be driven by a need to be 'fashionable', that is, to be one of those schools with the latest technology. The latest technology should actually be the reason for the school to have the urge to progress in its usage of technology by taking on the challenge of using it in the classroom. Earle, (2002) states that, it is futile having the resources if leadership does not set up organizational and management structures to ensure the use of resources is maximized particularly in the integration of ICTs pedagogically. The potential of ICTs can only be realized if the principal as the manager or driver for this change is involved in steering this process otherwise his negligence in this role is disabling ICT integration.

4.3.1.2. The principal's ICT in education vision and goals

At a broader level, the principal is aware of the value of ICT. In fact his words that proclaim, '*surrounded by technology"* seem to imply that he is associating availability of ICT resources with participation in the current trends. Since principals are in a position to work with others on building a vision, creating networks, negotiating boundaries, aligning tasks and ensuring that accountabilities are addressed to make sure ICTs are not just additional tools but an integral part of teaching and learning.

The vision of the school for ICT in education is: "*..... to provide teachers and learners with the opportunity to use ICT"* and the principal says he is proud to say that the school has achieved this. He says, *"With regards to the vision, it is for the learners to be computer literate so that they have some computer skills when they leave the school."* It seems that his vision is limited to computer literacy. There is no mention of using the computers in the classroom to teach or learn. In fact, when he was asked whether the teachers integrate ICT into their teaching, his response was "….. *I don't really think that the*

use of the computer would make a very big impact on learning because good teachers can do as good a job as the computer…many teachers do not use ICTs to teach, except for worksheets and personal research for teaching, but they are doing an excellent job…we do have a very good pass rate." To him, importance need not be given to ICT usage in the classroom since the school's learning outcomes are being achieved without the use of ICT anywhere. What the school population here lacks is exposure to the use of a tool it needs to participate productively in a society that is fast relying on modern technology for its 'survival' in the information world.

The leader's vision steers the direction towards achieving educational goals through the use of ICTs. ICT pedagogical integration is a process that has to be achieved by both the leader and the teachers together. Yet, the teachers that were interviewed stated that they did not even know an ICT in education policy existed in their school and yet it was critical that they be aware so that they could become participants in achieving the goal.

The ICT in education vision and achievement of goals relies upon the leader through strategic implementation of the ICT process. A good leader plays an influential role in envisaging vision and the realization of ICT goals of a school. It is, therefore, very important that clear goals are distinguished and attention and emphasis is given to achieving them. In this case, the principal needs to undergo development himself in ICT so he can understand the critical importance of implementing ICT pedagogical integration, hence, motivate his teachers towards achieving the same goal.

The policy must be designed in collaboration with all the stakeholders concerned and implemented suitably. The fact that teachers were not aware of the policy is evident that they were not consulted in its formulation. Cohen (2003) contends that most schools' inability to integrate ICT is due to the lack of knowledge and awareness of the value of ICT integration by the principals and hence they should undergo intense ICT training to promote its implementation.

More effort is needed on the part of the principal to initiate and emphasize the vision and goals for ICT pedagogical integration so that teachers can envisage the same goals and work towards achieving them. This is a direct reflection on the leader's attitude where he does not take ICT policy seriously and thereby disable the potential for ICT integration at a higher level.

4.3.1.3 New curriculum

The priority given to CAPS implementation over the inclusion of ICT in the teaching and learning activities has constrained ICT integration in this school. The principal mentioned that "*….there are no funds to invest in the upgrade or upkeep of the ICT resources since the existing funds must be used to purchase textbooks for the new curriculum (CAPS)*". It is important for managers as leaders of the curriculum to understand that ICT were not meant to replace the curriculum, instead they are meant to enhance learning and empower learners to think and apply constructively in innovative lessons. There seems to be a misconception between the new curriculum and the use of ICTs. The curriculum provides a guideline for a teacher which is standardized in the country; ICTs are tools used to enhance learning using various teaching strategies. It does not mean that by integrating ICTs in the curriculum, a diversion from the curriculum takes place. The principal's response is that the curriculum or latest policy does not make provisions for ICT integration and, therefore, he does not prioritize the use of ICT. In fact, he refers to ICT integration as being "*secondary"* to CAPS. This misconception by the principal constrains progress in ICT pedagogical integration at the school.

Perhaps the greatest factor that constrains all South African public schools in the pedagogical integration of ICTs at a high level is the DoE ICT policy which was designed without much consideration to the consolidation of the use of ICT within the curriculum, leaving the ICT integration process as optional, hence the discrepancies within a school between different teachers in each class.

4.3.1.4 Needs analysis; driving the process

The principal has identified the school's need for ICT integration and has taken the initiative to address them. He has organized ICT short courses at the school to curb teachers' lack of ICT integration skills, but these seem not to have prepared them for ICT integration in the classroom. He has also addressed shortages of resources by purchasing more technologies since 2008. These technologies include the SMARTBOARD and Data projectors and Lap Tops. However, there is no evidence that he has done anything to provide teachers with time to familiarize themselves with these new technologies in the context of teaching.

Technical support is one of the critical needs for a teacher to run an uninterrupted lesson with ICTs and yet the principal has not made sure this service is available. Although, he has identified the needs of the staff by arranging for internal and external developmental workshops for teachers to become competent in the use of ICTs, these courses were arranged internally. Integration is not taking place at a high level.

The leader's duty is to conduct a needs analysis of the teachers' preparedness to integrate ICTs, as it is the leader who should harnesses commitment to improve teaching and learning through ICT pedagogical integration (Haynes, 2007). This is an important factor in driving and managing change in the use of ICT in pedagogy. The needs analysis was partially fulfilled by developing teachers with ICT skills and providing technology, but not the skill to integrate ICT in the classroom. He should motivate them to implement what has been learnt and provide structures for achievement of the goals by giving time frames and having a system of monitoring the implementation process.

The needs analysis of the teaching staff was conducted, but the individual needs of the teachers were not addressed. Schrum et al. (2011:3) stress this requirement by saying: "An organization will not change until individuals within it change." It is for this reason that the principal has to drive the ICT integration process efficiently, and this poses a major constraint.

The principal's lack of interest in ICT pedagogical integration at this school has constrained the progress in ICT integration resulting in the school integrating at a low level. Much has to be done in order to improve on the level of ICT integration. There is an urgent need for leadership strategies to become more assertive and proactive in the implementation of ICT integration at this school in achieving the intended goals that are needed.

4.3.2 The role that policy plays in promoting ICT integration

The existence of the present ICT policy at this school was designed by an ex-ICT teacher who had left about three years previously. This policy has not been updated or re- visited since then. The significance of the ICT policy is minimal at this school.

If a policy that is supposed to be an important document for ICT implementation is not a working document, then not much is expected in its implementation. Although this school has an

ICT policy which is an enabling factor, the constraining factor is that it is not given much importance. It appears that the presence of the school's ICT policy was only to meet the department of education's needs and is a "showpiece" because all teachers that were interviewed stated that they were not aware that an ICT policy existed in their school yet the principal confirmed that there was a school ICT policy. This poses as a constraining factor in the ICT integration process as teachers have not been exposed to the ICT policy hence being deprived of the guidelines as to their expectations in the ICT integration process. This factor forms the basis for the execution of any project. It is very clear that in this school the policy is not valued.

It is through the ICT policy that a school's vision and teaching philosophies are carried out (UNESCO, 2002; Tinio, 2002). Hennessy et al. (2010) contend that ICT policies are expected to provide guidance, and failure to do so means that individual school and classroom innovations would be unlikely to be sustained. (Jones & Kozma, 2003 in Hennessy et al., 2010; Trucano, 2005) state that ICT policies should provide a rationale, a set of clear and specific goals and objectives that define interim and long term targets, and a vision clearly laid out in the policy that should be shared by all stakeholders in successfully achieving the goals in the school. Teachers, who are the implementers, have not even been consulted in its formulation. If a policy is not given importance as in this case the implication is that there is no urgency in its execution.

The ICT policy displays no significance in this school. The lack of an awareness of the ICT policy at the school is already a constraint because the policy provides the basis for implementation and if the basic school guidelines are absent, then development in the implementation process will suffer. Although at national level the policy has guidelines and strategies for its implementation, that is absent at this school. Moll and Ndlovu,(2009) contend that the ICT policy must be refined with explicit guidelines if implementation of ICT integration is to be successful. This school is unique and for that reason it needs its own guidelines and strategies that will only work in this context where teachers as implementers are actively involved, if success is to be attained in the pedagogical integration of ICTs.

4.3.3 Funding

An allocation for ICT resources is essential for the sake of progress. This school has limited software programmes to promote integration. If ICT pedagogical integration is to take place, then a range of ICT resources must be available, as limited resources constrains the process. The ICT teacher had indicated she used a South African programme for the computer literacy lessons and that programme is not adequate enough to promote ICT integration. This is due to the lack of funds to purchase appropriate software.

The principal had stated that the annual school fee is quite low and these funds are utilized for other important needs of the school and therefore there is no allocation for ICT resources in the school's budget. He further stated that the existing ICT resources available at the school were sponsored by the school's governing body. In order for any project to be successfully enabled, there should be funds available to sustain the project. The aspect of allocating funding that has been excluded from the ICT policy constrains the sustenance of ICT integration in the school because teachers have little opportunity to explore and try out new and the latest software due to the restriction of funds. This may also discourage teachers from exploring the use of ICT in the classroom.

4.3.4 Various factors at school level

4.3.4.1 ICT resources available at the school

This school seems to have more than the fundamental requirements for an ICT integration environment. The Table below illustrates the resources available for teacher and learner use at the school

ICTs	Quantity	Located	Connectivity: Internet	Access
1. SMART BOARD	1	Media center	Yes	Teachers
2. Desk Tops				
2.1	30	Computer lab.	Yes	Learners
2.2	5	Media center	Yes	Learners
2.3	8	Staff room	Yes	Teachers
2.4	4	Admin. block	Yes	Secretaries
3. Lap tops with data projector	3			
3.1 Fixed	1	Media center	No	Teachers
3.2 Fixed	1	Science lab.	No	Teachers
3.3 Portable	1	KDA programme	No	Teachers
4. <u>Multimedia</u>				
4.1 Television	1	Media center	No	Teachers
4.2 Video	1	Media center	No	Teachers
4.3 DVD player	1	Media center	No	Teachers
4.4 OHP/ Screens	33	Every class	No	Teachers

Table 4.2: Resources available at the school

There are a number of venues where a variety of ICTs can be accessed by both teachers and learners who should be using them for educational purposes at any given time. Schools that are well resourced like this one are at an advantage in integrating as they have the basis for initiating the implementation of ICT integration. This school should actually be leading in the utilization of ICT in the classroom as both infrastructure and hardware is available. The following table gives evidence of poor uptake and low usage of ICT in the classroom.

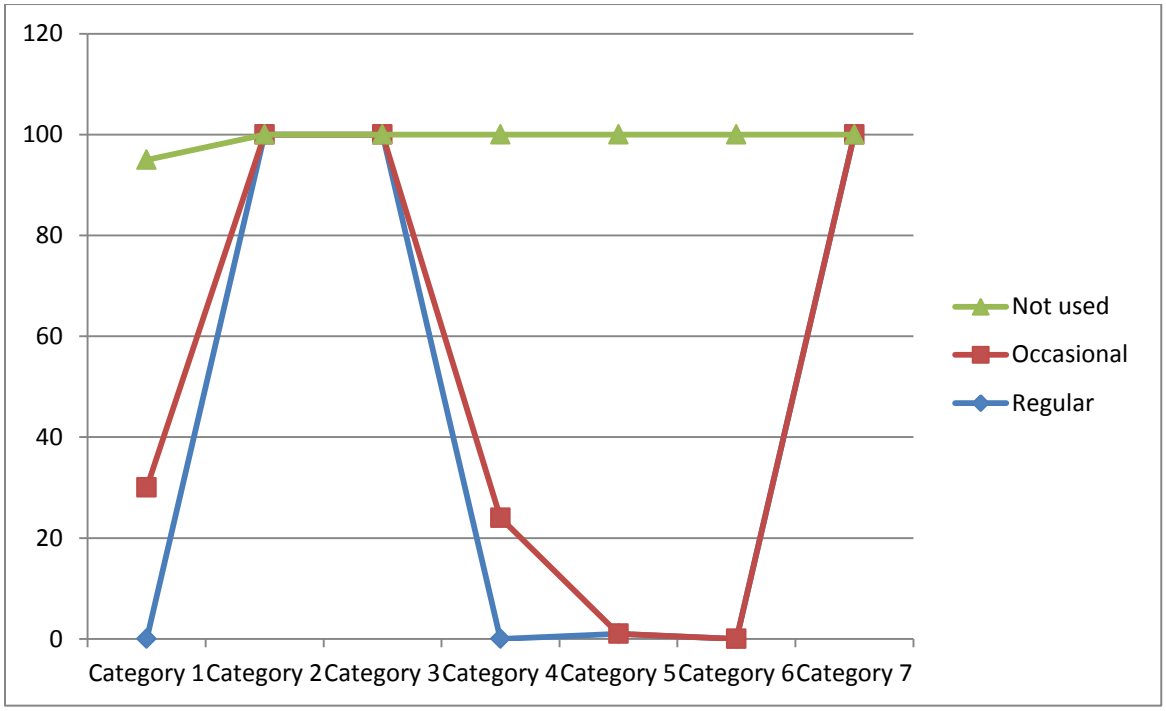


Table 4.3: Teachers use of the ICT excluding multi- media resources

Key for Categories

Category 1: Lap Top and Data Projector used for PowerPoint Presentations

Category 2: Desk Top Computer (Word) used for worksheets

Category 3: Desk Top Computer (Excel) used for recording learners marks

Category 4: SMARTBOARD use for teaching and learning

Category 5: Computer literacy in the computer lab only by ICT teacher.

Category 6: Interactive lessons using ICTs

Category 7: Internet usage

The Table above displays the ICT usage by teachers at the school. 0% of the teachers use the lap top and data projector regularly, 30% of the teachers use the equipment occasionally (once or maximum twice in a year), whilst 70% of the teachers do not use the equipment at all. All the teachers (100%) use the desk top computer for planning and preparation purposes; worksheets

and the internet for research as well as the Excel programme for marks. 0% of the teachers use the SMART BOARD regularly, 24% use it occasionally and 76% do not use at all. Computer lab is only used by the ICT teacher who teaches computer literacy. Learners have half an hour computer literacy lessons in a week. None of the teachers integrate ICT pedagogically.

An overview of the ICT usage at the school indicates that teachers mostly use the ICTs for planning and preparation purposes. Few teachers have used ICT occasionally in the classroom. The school has the potential to utilize the ICT at a much higher level. The enabling factor is that this school is well resourced and teachers have the opportunity to try out different ICT equipment. Interestingly, despite the fact that this school has several ICT resources for a successful pedagogical integration of ICT, ICT integration is still not taking place at a higher level. What could be the factor that constrains the effective pedagogical integration of ICT at this school when there are such a vast variety of ICT resources?

The term availability has several connotations and in this case available resources should not be viewed at face value. Lack of access to technology is inevitably a major barrier in the implementation of ICT pedagogical integration, and yet availability does not necessarily translate into use (Mumtaz, 2000 & Hennessey et al., 2010). The table shows regular use of technology for preparation (worksheets and internet) and that confirms the principal's proclamation earlier on. The usage that this school should be working on if the potential of ICT is to be realized for achieving education goals is when teachers integrate this into the curriculum.

One of the factors constraining the ICT integration as teachers indicated in this school is the availability of sufficient ICT resources. Some of the responses from the interviews to inadequate ICT resources were:

> Teacher 2 *"there are 7 computers between 33 teachers…Hardly get to use the computer (once a month)"; and Teacher 4: "We have a huge lack of resources, we use a booking system for the portable data projector, but since there are 4 classes in each grade, teachers are unable to use the equipment regularly because they have to consider the other teachers as well, and often when required the equipment is not readily available."*

Number of Teachers	ICT Resource	Ratio
33	Desk Top Computers: 7	33:7
33	SMARTBOARD: 1	33: 1
33	Lap Top/Data Projector: 3	33: 3
Number of Learners 900	Desk Top Computers 44	900: 44

4.4 Table that shows the ratio of teachers and learners to available resources

The ratio of teacher to computer is 33:7, teacher to SMART BOARD is 33:1 and teacher to lap top/ data projector is 33: 3. Teachers have expressed their concerns regarding the inadequate availability of ICT resources especially at desired times and that results in the non-use in the classrooms. The ratio of learner to computer is over 900:44 and that constrains possibilities of using them. Albirini, (2006) states: "insufficient computer resources were one of the greatest impediments to technology integration in the classroom." Although this school portrays a wide range of ICT resources, these are still insufficient to use regularly, for exploration and for familiarity as computers have to be shared between many teachers.

Another factor that constrains ICT integration is the pre-booking of equipment for use since the ICT resources are insufficient. There are clashes at times when more than one teacher needs to use the equipment. In this case, the ICTs are not readily available when needed and, therefore, teachers may not keep the equipment for a long time since other teachers may need to use it. This becomes difficult for teachers who need to deliver the same lesson to four classes (There are four classes in each grade) on the same day due to the sequence of the lessons planned. In order for an ICT integrative lesson to be executed successfully, good planning is essential (Bingimlas, 2009). Teachers plan their work in advance; the constraint is that the equipment may not be available at the specific time needed, which may result in teachers resorting to traditional methods of teaching.

Due to the fact that teachers don't have ICTs available in their classrooms, integration at a higher level is constrained because ICT integration at a high level entails learners actively participating in building and creating their knowledge (Scrimshaw, 2004; ACOT, 1995; UNESCO, 2002; Wang, 2008; Strydom & Thomson, 2005; Wagner, 2006 and Thornburg, 1997)

through ICT interactive activities. This can only be possible if the necessary resources are adequately available for learners to use in their learning environment.

Even though there is such an extensive array of resources, the ICT integration process becomes disabled as available resources are inadequate

4.3.4.2 Accessibility

Access to ICT resources is an important feature in the integration process. The term ICT access is broad and refers to several different situations within a school, such as access to ICT resources, access to the internet, access to technical assistance and access to the ICT policy. The lack of access poses a constraint which discourages teachers from integrating ICT in their teaching (Bingimlas 2009; Kozma, McGhee, Quellmalz, & Zalles, 2004).

Hardware

There has been a common misconception that access to ICT resources promotes the pedagogical integration of ICTs. Some of the responses by the teachers indicate that access to resources can impact on the use of ICTs in the classrooms. Teachers preferred having their own ICTs in the classrooms so that they can use the ICTs frequently and at the same time get acquainted with the use of the equipment to overcome their technical difficulties in connection with the technology. These responses affirm the need for more ICTs to be available if pedagogical integration is to take place.

Teacher 1: "*It would be better if we could have computers in the classrooms. If teachers had more access in the classroom, it would definitely make it easier."*

Teacher 2: "*Availability of resources….It would make it much easier if each classroom has access to computers"* and

Teacher 3: "*We need computers in every class so that we can use it more often for teaching and gain confidence in the use of computers."*

Despite the availability of the ICT resources, teachers use the ICTs minimally for basic planning and preparation. Constraining factors such as time, availability and convenience affect the accessibility of the ICT resources within this school. The ICTs are located at 4 different sites at the school. This requires the teachers to use the resources on availability when teachers can get to the site, in the time they can avail themselves within their teaching schedule.
Secondly, sharing of the equipment becomes a constraint when they are not accessible at the teachers' convenience due to the booking system. The ICT teacher (Teacher 4) had expressed the following problems experienced with the booking system:

> "*We have a huge lack of resources, we use a booking system for the portable data projector, but since there are 4 classes in each grade, teachers are unable to use the equipment regularly because they have to consider the other teachers as well, and often when required the equipment is not readily available because the data projector and lap top is mostly used for the KDA programme (physical education programme), the other alternative would be to take learners to the media center to use the fixed equipment that creates unnecessary problems of movements from classes and availability of the media centre."*

The booking of equipment prior to use does not work all the time because at times teachers forget to book the equipment in advance and, furthermore, the sharing of one data projector set does not give a teacher much time to spend with the equipment especially if the teacher has to use it for four different classes. Sicilia, (2005) argues that the booking and sharing of equipment does not promote ICT integration because that way, teachers are denied adequate access to the technology. Although the booking system is effective for control of equipment, it works better if there are adequate ICT resources available. However, this system seems to constrain ICT integration because the limited resources are not available for teachers when required thus discouraging teachers from ICT usage and inevitably ICT integration progression.

Software

Appropriate software used in ICT integration can generate enhanced learning opportunities if accessible. The ICT teacher mentioned that the software available in the computer lab is inappropriate.

"*The programmes used are Inkatha kids, Maths/ English story that is not appropriate because they are American stories and the levels are very high…it is too difficult, We do have a grade 1-7 South African product which is not a good product because there is not enough depth for each term…small content covered each term."*

The lack of accessibility to appropriate software at the school constrains the ICT integration process as the learners are deprived the opportunity to expand their ICT dimensions in the ICT class. Becta, (2004) contends that the inaccessibility of resources is not due to non – availability of software but could be a result of factors such as poor quality, inappropriate (not localized content) software or a lack of personal access to teachers. Using computer software once a week for half an hour cannot facilitate effective integration because half an hour is insufficient time to interact with the tool to assimilate knowledge.

The software programmes that are available at this school contain basic application activities that do not allow learners to generate their own knowledge and is no different than the activities from a textbook. Therefore the use of the desk top computers in the computer lab by this school is none other than basic computer literacy. Furthermore, these programmes work independently from the work schedule or syllabus in which the learning area, specialized teacher would be covering content from. Hence, it is necessary for all teachers to be exposed to appropriate software that is directly linked to the content so that teachers can integrate the ICT with the content appropriately.

Internet

Internet accessibility affords teachers the greatest opportunities to explore and expand their teaching dimensions. Inadvertently, this promotes the pedagogical integration of ICTs. According to Bingimlas (2009) lack of access to the internet is one of the most common barriers facing several countries. Fortunately, all desktop computers available throughout this school have good internet connection which is an enabling factor. They have not experienced any problems with connectivity. The internet is always connected throughout the school day unless there is a problem with electricity which is seldom experienced. Learners use the internet for information purposes in the media centre whilst teachers use the internet for the same purpose in

the staffroom. Although this school has made the internet facility accessible to all, pedagogical integration of ICTs at a high level is not happening.

Accessibility to resources seems have more significance than their availability. And yet on the contrary, inadequate resources limit accessibility. It is, therefore, important that when resources are available, strategies are in place to ensure sufficient accessibility that will guarantee effective ICT integration at any given point in time in a school.

4.3.5 Technical support

The provision of technical support plays a pivotal role in the implementation of pedagogical ICT integration. Teachers have stated that their inability to integrate ICT effectively is because of the lack of technical support received. Teacher1 echoed the same view as many of the other teachers that were interviewed as well as from the responses of the teachers in the questionnaires that : "*We have a staff member who is able to assist with basic technical skills, however, she also teaches, it becomes difficult to get immediate technical assistance."* There is very little technical support provided to teachers at this school because of the lack of funds. The ICT teacher has basic technical skills yet she is expected to assist with 'whatever' technical problems teachers encounter during lessons. This expectation is unrealistic as the same teacher has a normal teaching load and is not readily available. This means that in order to assist a teacher during class time she would have to leave her class with learners unattended to assist the teacher who is using the equipment. This is rather risky and to avoid any problems she tries to assist teachers only when she has a free period and this poses a constraint for teachers who would like to use the equipment when she is teaching.

The school receives technical assistance from a parent who is ICT skilled in the mornings when he drops off his child in the morning. This does not assist a teacher experiencing technical difficulties during a lesson later in the day. Whether provided by in-school staff or external service providers, or both, technical support specialists are essential to the continued viability of ICT use in any given school. While the technical support requirements of an institution depend ultimately on what and how technology is deployed and used, general competencies that are required would be in the installation, operation, and maintenance of technical equipment (including software), network administration, and network security. Without on-site technical

support, much time and money may be lost due to technical breakdowns. Becta, (2004) mentioned that without technical support in a school, it is likely that technical maintenance will not take place regularly which results in a much higher risk of technical breakdowns. This implies that it is necessary for this school to have full time technical assistance to prevent any time and money wastage as well as to ensure a smooth integration process. This can also promote integration at a high level as teachers are motivated to use the ICT confidently, knowing full well that they have stand-by technical assistance that will not hinder progress of the lesson planned.

The teachers who attempt to use the SMART BOARD in the media centre or the data projector and lap top in the classroom are not skilled in the use of the equipment. As a result, they are quite discouraged to use the ICT resources. Teacher3: "…*many teachers were de-motivated when the company who provided the whiteboard had sent a trainer to demonstrate its use to all the teachers…..he couldn't get the white board to work. The SMART BOARDS also have a lot of glitches the pen was not corresponding with the data on the screen…."* This discouraged many teachers from using the SMART BOARD as they felt that if the professionals could not overcome the technical problems then they had lost hope. The trainer did not have adequate skills in the operation of the new equipment; therefore, the teachers could not experience the relevant advantage of the use of the SMART board. It is disturbing that no follow up was made to ensure teachers eventually could get to a position where they grasped the operational and the integration skills for this gadget. The presence of such an expensive and yet useful ICT cannot promote pedagogical integration in this school simply because there is no one with technical know- how in the school.

Sicilia, (2005) in Bingimlas (2009), contends that technical problems were found to be a major barrier for teachers and this barrier "impeded the smooth delivery of the lesson or the natural flow of the classroom activity." Technical challenges faced by teachers discourages them from using ICTs (Goktas et al, 2009), hence the low or basic level of ICT usage. In order to overcome these challenges, the need for a full time technical specialist is vital for further progress in ICT integration to take place.

Teacher 3*:"We definitely do not have sufficient technical support."* Technical support is the basic factor underlying ICT pedagogical integration. Undoubtedly, lack of technical support in

this school is one of the prominent factors hindering teachers' readiness and confidence in using ICTs for teaching and learning (Lewis, 2003; Tella et al., 2007; Schrimshaw, 2004 & Pelgrum, 2001 in Bingimlas (2009).

4.3.6 Time

Time is essential for various aspects in ICT pedagogical integration such as time needed to plan and prepare, time needed to access ICTs and time needed to take learners to the respective venues with the ICTs. Without time, even teachers that have the confidence and competence in the use of ICTs are not utilizing technologies to the maximum (Jung, 2005; Bingimlas, 2009 & Henessy et al, 2010). Some teachers that were interviewed at this school stated that they carried out ICT integrated lessons once in a while because they did not have much time to plan lessons using ICTs and that the technologies required to integrate ICTs were not always readily available to try out. Teachers also felt that they had many commitments at school that restricted them from planning such lessons. The only way out was if teachers worked from home. Unfortunately, most teachers do not have their own home access to ICTs. All of these time related aspects posed a constraint to ICT integration in this school.

Some teachers had indicated that hiring of the equipment in the class or taking learners to the media centre for the use of ICTs was problematic due to lack of frequent use of equipment resulting in teachers not being confident in connecting the components of the ICT thus taking up teaching time to get the equipment to work. (Teacher 3) "*…it is very time consuming to book then fetch then connect which is quite a mission to set up, and often there are technical problems which results in delays then learners get restless."* Also, "*Time consuming to take learners to the centre, and then connecting the systems wastes a lot of time"* (Teacher 2). Access to ICTs plays an important role in time consumption; time is an underlying factor which can promote or constrain ICT pedagogical integration. In this school, time is of essence for the teachers if progression of ICT integration is to be made at a higher level.

Another time constraint challenging the pedagogical integration process is the content load in the curriculum that is expected to be achieved in a short space of time. Trucano (2005) contends that too often the curriculum in developing countries is rigid and overloaded, leaving little time for innovative classroom practice. Teachers at this school feel that due to the overloaded curriculum demands over and above the administrative requirements, they utilize most of their class time in

the completion of the work schedules. They focus on the achievement of the required assessment standards and therefore don't have extra time to use ICTs, especially with the lack of technical support.

It seems that the facilitation of pedagogical ICT integration has been misconceived. Although time is needed for planning of ICT integrative lessons, infusion of ICT within a lesson is not time consuming. It takes the same time to integrate ICT as the use of a textbook in a traditional (teacher-centered) class. It is evident that teachers need much training in ICT integrative skills to facilitate making quick decisions on how technology can be incorporated in a lesson. Although integrating ICTs in lessons does not take up time, the teachers' claims are justified because of time required to plan, access and practice of ICTs, for satisfying administrative and curriculum requirements and to alleviate technical difficulties.
The teachers said that it is very frustrating for them who are already bombarded with paper overload, meeting deadlines, attending meetings and workshops and working under pressure to complete the syllabus to undertake this new pedagogical strategy that requires distinct skills. These demands are taken more seriously in a school like the one under study that is performing well in all its activities (excluding ICT integration).

Several researchers (Alwani, 2005; Becta, 2004; Beggs, 2000; Schoepp, 2005; Sicilia, 2005 in Bingimlas, 2009) as well as Hennessey et al. (2010) and Dias, 1999; Wang and Chan, 1995; Ertmer, 1999 and Manternach-Wigans 1999 in Divaharan (2010) claim that teachers' perceptions of a lack of time for them to learn and integrate technology into the classroom is a contributing factor that constrained ICT integration. Therefore, teachers should be given more time to explore the technologies and the prospects of using technology in pedagogy for their own professional development if ICT integration is to be enabled and achieved at a high level.

4.3.7 Professional development of teachers

Most of the teachers in this school seem to prefer the traditional methods of teaching despite having attended external and internal workshops held by the ICT teacher which were developmental courses for the enablement of the use of ICTs in the classroom. It was surprising that they still expressed concern that they were inadequately trained and not ready to integrate

ICT pedagogically. The responses from some of the teachers were: "…*very little training on ICT skills.*"(Teacher 2) and "*There should be valuable courses or workshops provided for teachers to develop their ICT integration ability. There is no lack of enthusiasm by the teachers, instead our teachers need to be trained so that they feel confident enough to use ICT*" (Teacher 3).Hence, there is a need for capacity building in ICT skills and knowledge for progression to be made in ICT pedagogical integration from the present level (low) to the next level.

4.3.7.1 Capacity building

Teachers at this school had attended several external workshops on the use of ICTs as well as internal workshops in PowerPoint, Excel and Word, yet most of the teachers at the school are not integrating ICT at all. The mere attendance of developmental workshops and courses does not guarantee the successful integration of ICT. It is the suitability, relevance and application of the trainings that determines confident usage of ICT in the classroom. Capacity building is an essential factor (Chigona, 2010) that if not appropriately structured by the trainer then constrains ICT integration as the skills imparted may not be useful and empowering to face the challenge of using them in the classroom. Considering that the ICT infrastructure is in place with a few constraints to be overcome, if teachers are trained appropriately then the transition to the higher level (Ali et al, 2009; UNESCO, 2002) of ICT integration will be enabled.

4.3.7.2 ICT skills

Although the teachers have received basic skills in PowerPoint, Excel, Word, and Internet and in the vague use of the SMARTBOARD, these skills are not sufficient for teachers to be competent in integrating ICTs into the curriculum effectively. In fact the teachers had even indicated that their training is inadequate by saying: (Teacher 2) "*I need to learn how to use computers effectively to teach in lessons; I also find that there are technicalities in connecting the ICT, so I need to know confidently how to connect."*

The teachers have to undergo specialized training in ICT integration which did not happen at this school. Their training was a 'one size fits all' approach where the skills acquired could be used in any situation; such are proficiencies to administer administrative activities. Subject content demands specific pedagogical strategies that are unique to the field. Researchers (Pelgrum, 2001; Beggs, 2000; Becta, 2004 & Cox et al., 1999a) argue that in order for an effective ICT integration process to take place so that teachers can see the value of using ICTs, it

is very important that teachers' training focuses on pedagogical training and issues instead of just being able to use ICT tools. Unfortunately, training opportunities have been well intentioned, but misplaced, supply-driven initiatives that are very limited in their availability and inconsistent in the quality of training provided (Hennesey et al., 2010; Unwin, 2004). The teachers mentioned that they experienced several technical difficulties in using the ICTs in the school. As a result teachers were often discouraged from use of ICTs in their teaching. There is a contention that the lack of technological competence, results in teachers not accepting or adopting ICTs in the classroom (Pelgrum, 2001; Al- Oteawi, 2002 & Mumtaz, 2000). Training teachers to efficiently use ICTs will develop their confidence in the use and in the basic technicalities. Although teachers will not be able to sort out the major technical problems, they will be able to handle the basic problems from their knowledge gained in the training received. It is therefore imperative that all schools have a full time technical assistant for integration of ICTs at a high level.

4.3.7.3 ICT knowledge

Teachers' knowledge of ICT integration is an integral part of its implementation. The inability of teachers to understand why they should use ICTs and how exactly they can use ICTs to help them teach better is invariably a challenge facing teachers in the integration process. Cox, Preston, and Cox (1999a) contend that teachers who are confident in the use of ICTs in their class understand its usefulness in their teaching and personal work and thus extend the use of ICTs.

The findings from the school show that the teachers lack knowledge on the pedagogical integration of ICTs is a serious constraint. This is revealed in the questionnaires and from the interviews. 23/33 teachers alleged that they had no idea what is meant by 'integration' and yet the understanding of the concept is the basis for the implementation. The rest of the teachers indicated that they were integrating and yet when asked how they integrated, the activities were limited to planning and preparation. This is indicative of their lack of a deeper understanding of what ICT integration entails as defined in the White Paper for e-Education (2004). They also indicated that they have no time to integrate ICTs in the already overloaded curriculum yet ICTs should be used in conjunction with the content not a lesson by itself. Some of the teachers have

indicated that they are de-motivated to use ICTs due to the technical difficulties experienced in connecting the components of the equipment. The lack of knowledge to integrate ICTs is a constraint that hinders progress in ICT integration. Bingimlas (2009) contends that several researchers (Becta, 2004; Newhouse, 2002; Pelgrum, 2001; Al- Oteawi, 2002; Albirini, 2006; Empirica, 2006; Balanskat et al., 2006 & Almohaissin, 2006) have reported that the research conducted in different countries such as Australia, Saudi Arabia, Syria, Europe, Denmark and from other surveys carried out throughout 26 countries indicates that teachers who do not integrate ICTs in their classrooms lack ICT knowledge and skills. The teachers at this school can integrate ICT at a much higher level if they undergo intense professional development that addresses ICT knowledge that helps them understand and acquire ICT skills in the context of their subjects. This training will in turn provide the knowledge for ICT integration essential for implementation so that the process is enabled.

Unfortunately, these teachers have been exposed to professional development in ICT that is strong on using the ICT tools and generic on using the ICT tools to integrate into the curriculum. Much consideration has to be given to the type of ICT training provided for ICT to be integrated at a higher level. It is only through appropriate professional development that ICT integration is enabled and progress towards a higher level is made.

4.4 School level of pedagogical integration

This school is already at an advantage in having some of the major factors such as ICT infrastructure and access to the ICTs in place. Therefore, not much effort is required to overcome the constraints if all the stakeholders within the school work towards improving the ICT environment so that the school can possibly integrate ICTs at a much higher level.
The enabling and constraining factors discussed influences the level at which ICTs are integrated at the school, hence, placing the school at a particular level on the UNESCO model (2002). These levels assist the school to identify their status so that they are able to pave a way forward to the next level.

The criteria used to position this school at a particular level are based on the activities of the teachers in their usage of ICTs. The teachers indicated that they mainly use ICTs for planning

and preparation (Internet, Word and Excel) of lessons but seldom use them in the classroom. Learners also have access to the internet for research purposes and the ICT teacher uses an English and Maths. software programme for learners' activities in the ICT lab.

UNESCO model of ICT integration (2002).

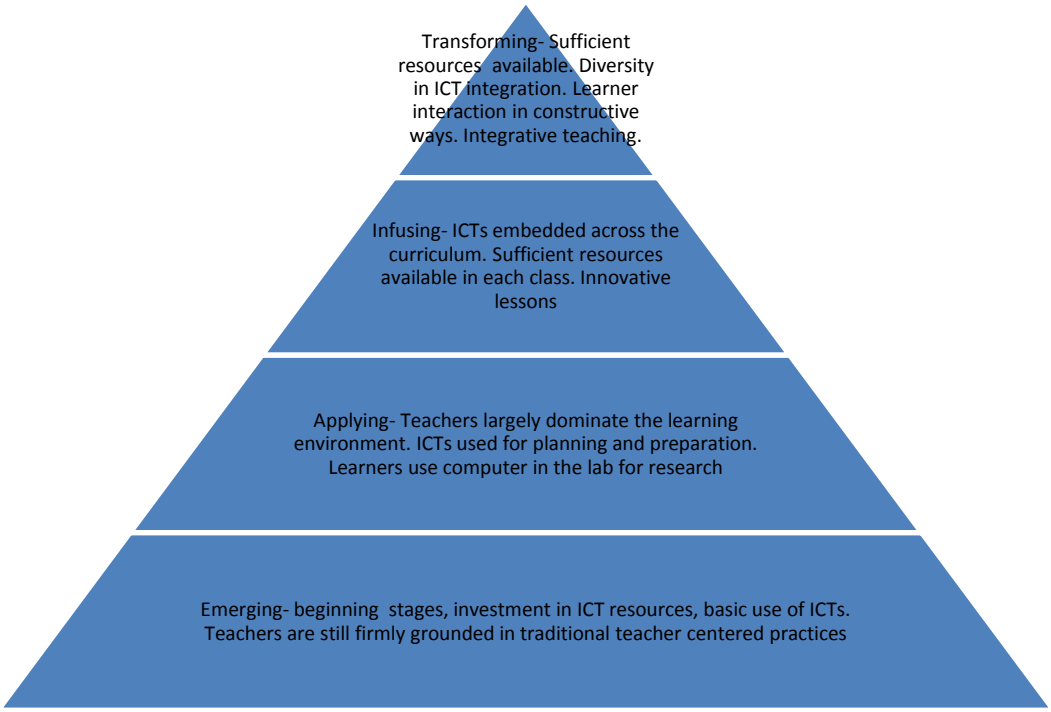


Figure 4.1: Description of levels of ICT integration adapted from UNESCO (2002)

Based on the ICT activities held at the school, initially, it was quite a difficult task placing the school at a particular level of integration because not all teachers use ICTs in their teaching as mostly use them for preparation and application of basic skills. However, in consideration of the general use of ICTs at the school, ICT integration is taking place at the *applying* stage of the lower level of integration in that all facilities are in place, some teachers have the ability to operate the computer, learners have access to the internet to be able to research and they receive computer literacy lessons.

4.5 Conclusion

The assumption the researcher had at the beginning of this study was that, for the school to integrate ICT pedagogically at a higher level, the constraints will have to be overcome; enablers

will have to dominate. However, Bingimlas (2009) iterates that the presence of all the factors "increases the possibility of excellent integration of ICT in learning and teaching opportunities." The factors referred to are the enabling elements in the school. The factors that seemed to be enabling in this school, such as the availability of resources and training of teachers did not promote ICT integration or its progression. Instead, their presence brought the realization that ICT pedagogical integration is a complex process. Its complexity is brought about by the fact that particular behavior or action must be displayed and inclined towards desirable ICT integration outcomes. It is possible, for instance, that if the school had more constraints and yet had a few of the desired or critical enablers, it would be able to easily move from its integration levels in 2008 to higher levels in 2011. Therefore, this school's progression has little or nothing to do with whether the enablers are stronger or not as the claim in the conceptual framework.

Chapter 5: Summary, Conclusion and Recommendations

5.1 Introduction

This study set out to document the factors that enable or constrain the pedagogical integration of ICT and how these factors influenced the level at which this particular South African school is integrating ICT.

The factors that enable and constrain the pedagogical integration of ICT were reviewed and linked to the level of ICT integration thus emphasizing how the independent (factors) variables affect the dependant variables (level of integration).

The UNESCO model (2002) framework was used to conceptualize the level of ICT integration at this school and to give a broad view of the extent of use of ICT.

The literature was used to document the environment beyond this school which attributed to the general activities throughout the world with regards to the challenges and barriers facing ICT integration in South Africa.

The principal, all teachers as well as the ICT teacher participated in this empirical study and supplied data mainly through self-reporting questionnaires and a few teachers participated in informal interviews that were individually held.

The data was then analyzed and represented thematically. The focus areas of the data analysis were the enabling and constraining factors that either promoted or impeded on ICT integration within the school.

The aim of this chapter is to synthesize the findings of the study and relate these to the literature review so as to address the research questions. The research questions are brought forward from Chapter 1 to provide the organizational framework for this chapter:
What enabling and constraining factors in this school determine its level of ICT pedagogical integration?

On addressing the above research questions, the chapter concludes with recommendations including proposals that are envisaged to be crucial in addressing some of the gaps at government level as well as within the school for effective pedagogical integration of ICT. These include: a review of the ICT policy; appropriate and ongoing training for all teachers; afford teachers more time to try out these technologies; and, lastly, provision of technical support. This chapter concludes with the proposition of prospective further research stemming from this study.

Sub-questions

1. What factors influence the ICT pedagogical integration in this school?
2. What is the level of pedagogical integration of ICTs at this school?
3. What factors are likely to promote progression in the ICT integration of this school?
4. What factors is disabling progression in pedagogical integration of this school?

5.2 Summary of findings

The findings reveal that although this is a well functioning school with a good ICT infrastructure, priority is not given to ICT integration at this school and the leader shows very little initiative in promoting the use of ICT in teaching.

Although the school does have an ICT policy, it was designed a long time ago by the ICT teacher who was teaching at the school previously. The ICT policy is not given importance at this school. Teachers are not even aware of the existence of the ICT policy. This also implies that there is a lack of explicit guidelines for teachers to implement ICT pedagogical integration due to the non exposure of the teachers to the ICT policy.

Teachers had received basic application training in ICT that included computer literacy and the use of the SMART BOARD. They have not been equipped with the necessary skills to be able to integrate ICT in their teaching and learning at a high level. Therefore, teachers require appropriate training for ICT integration.

There is very little technical support available for teachers hence de-motivating them from using the ICT, especially the SMART BOARD and lap top with the data projectors since teachers

experience difficulties connecting these and they are also afraid of technical breakdowns that waste time during lessons.

The teachers have mentioned that they do not have much time to plan integrative lessons since much preparation for the use of ICT in teaching and learning is needed. Teachers spend most of their time teaching during the school day and after school hours they are committed to the secondary needs of the school such as extra murals, administration and meetings. These give teachers little time to explore and maximize the use of ICT in the classroom.

They have limited free time to use the computers in the staffroom and very few of the teachers have home access to a computer to work from home. Furthermore, the portable equipment or SMART BOARD in the media center is not always available for use. Teachers have insinuated that they would improve the use of ICTs in their teaching if they had computers in their classes which would then make ICT more accessible.

Although a range of ICT resources are available, these are inadequate for the ratio of teachers to ICT in this school which constrains ICT integration.

The lack of funds constrains purchase of appropriate software, therefore, the software used in the computer laboratory is not very suitable. Priority is also not given to the upkeep and upgrade of ICT due to the lack of funds.

It is evident from the above findings that the teachers at this school are not making maximum use of the equipment. The school is integrating ICT at the low level '*applying stage*' by using ICT for planning and administration purposes and does have the potential to achieve much higher levels of ICT integration if the constrains are alleviated so that the school can progress towards the next level of integration on the UNESCO model (2002).

The findings reflect that there are many such well-resourced schools within South Africa that have the potential to integrate ICT at a high level but are not utilizing ICT well enough for the benefit of the learners. Unfortunately, schools that are well resourced, consider themselves to be under resourced, hence, using this factor as a hindrance to the integration process at the school.

5.3. Discussion

1. Various factors influence the pedagogical integration of ICT at this school. These factors include a wide range of resources; internet connection; teachers are trained in basic computer skills and open access to the ICT. Other prevalent factors that are present at this school are insufficient resources; poor leadership initiatives in creating an ICT educational perspective; lack of teacher awareness of the ICT policy; ICT policy lacking attributable guidelines; lack of access to ICT resources at teachers convenience; inappropriate software; lack of technical support; lack of time to explore and expand ICT innovatively; inadequate training and lack of ICT integration knowledge.

2. Initially when computers were installed, the school was at the emergent (1^{st} stage). In 2008 the school had then moved to the application stage and in 2011 it has not moved to the next stage, the school remains dormant at this stage. The presence of physical resources has not promoted advancement in their use by teachers. While teachers have the basic skills, they have not explored ICTs beyond basic application and they seem to be content with the impact of ICTs in their administrative work. The teachers have made little or no effort to improve their technical skills to afford them an integrative method of teaching with ICTs.

3. The availability of a wide range of resources and the application skills that teachers have are enabling factors. However, the presence of these enablers seems not to promote progression in the level of pedagogical integration because of their inadequacy. Although there are computers, the school has not purchased more to ensure quality access to both the teachers and learners. The basic skills acquired by the teachers only equip them to use computers for administrative purposes and representing lessons in a different mode (Strydom et al, 2005). If computers are well utilized they should facilitate generation of knowledge, which therefore means they should be used to develop learner thinking skills.

4. There are many constraints that inhibit the progression of this school from application to infusion. These constraints are so dominant that they make it impossible for the school to advance to the next level. In fact they overpower the few enablers, for instance, without training in ICT pedagogical integration, teachers are reluctant and will not make time to progress to the next level. If computers are not adequate for teachers and learners, they cannot spend quality

time with the machines to improve on their skills and be more comfortable in using the new tool to operate at a higher level.

5.4. Conclusion

The findings in this study clearly indicate that this school is integrating ICTs at the applying level (UNESCO, 2002) since 2008 and has not advanced to the next level. This study also reflects s that although the enablers at this school were dominated by the constraints (it is not the dominance of either of these that affect integration as described in the conceptual framework. It is the nature of the enablers that actually constrain progression to the next level, such as the quality of the factors (technical support, good ICT leadership and management, provision of ample time for teachers to integrate ICT and above all relevance of the training received by teachers) which is pivotal for the successful implementation of pedagogical ICT integration.

5.5. Recommendations

In considering the findings from this school, it is clearly evident that although the school is well resourced, teachers are not making maximum use of the ICT facilities hence placing the school at the '*applying stage*' of the lower level of integration. There are several underlying factors that contribute to this status and in order for this school to integrate ICTs effectively at a higher level the following recommendations are suggested for the school to make positive progress by moving to the next level of the model.

5.5.1. Management to set up organizational structures

Prioritize ICT policy and all stakeholder should be involved in ICT policy formulation-building vision, creating networks and negotiating boundaries

Develop a system of monitoring and evaluating ICT integration; various competencies (UNESCO, 2008) must be developed throughout the educational system for ICT integration to be successful because presently teachers are expected to integrate ICT yet there is no system of monitoring whether the teachers are using ICT in the classrooms or not. Furthermore, it is very difficult to assess the level of teacher competence in ICT integration unless a system is put in place for teachers to be evaluated accordingly. Therefore, a system should be in place to evaluate the level of competence with regards to ICT integration at the school. This evaluation could either be incentive driven along with an evaluation system

either incorporated in IQMS or on its own so that a guideline is provided to ICT trainers as to the needs of the school

Development of ICT skills by management for provision of ongoing support to teachers; the management should provide ongoing support to teachers in order to sustain and create an effective ICT integration environment

The management themselves must be competent in the use of ICT; have a broad understanding of the concept pedagogical integration of ICT, technicalities, curricular, administrative, financial and social dimensions of ICT use in the school. In order for an effective outcome, the leadership should be in a position to know exactly what the requirements are, have full knowledge and skills of the integration process and should be able to apply the skills (Brannigan, 2010). "Lead by example" and teachers will follow the cue. Leaders must take initiatives in developing themselves so that they set standards that are achievable at the school level.

5.5.2 School ICT policy

Awareness and prioritizing of the ICT policy with explicit guidelines for teachers to adopt and follow.

5.5.3 Professional development of teachers

Provision of appropriate intensive integrative ICT training for teachers that will prepare teachers with the necessary skills to confidently integrate ICT in the classroom
Training for teachers should be "tailor-made" for the needs of every teacher in the school
Teachers must receive ongoing support

Ideally, the initial phase in ICT training should begin at pre-service level and continue at in-service level. Pedagogical integration of ICT should become a fundamental part of the course structure at tertiary institutions. The training provided should be well structured and must assist teachers to not only develop ICT skills but also to be able to fully integrate ICT into the curriculum. In this way, the new generation of teachers would set the trend in schools whilst the older teachers develop themselves to meet the standards.

5.5.4 Time

Align the curriculum with educational outcomes; the curriculum is too rigid and overloaded, leaving little time for innovative classroom practices. National policies to help teachers integrate ICT into the classroom by correlating curricula and exams with incentives intended to be achieved.

There should be more time given for teachers to explore different avenues of the curriculum from pedagogical perspectives.

5.5.5 Technical support specialists

To sustain the continued viability of ICT use in this school, it is very necessary that the teachers receive full time technical support; teachers at the school seldom use the ICT equipment because of the difficulties experienced in connecting components of the ICT equipment which are time consuming and due to lack of technical skills of the teachers

On-site technical support (Mumtaz, 2000) can assist the school in many ways in saving time and money apart from boosting teacher confidence to integrate ICT.

5.5.6 Development of appropriate content

Development of appropriate content for all learning areas in the curriculum; a need to develop original content by adapting existing content matter into digital media

The school should invest in a few teachers who are interested in specializing in online content development; they could cascade their knowledge to the rest of the staff. In this way the school could save in the long run and develop its own specialized content for the school.

5.5.7 Monitoring of the ICT integration process by the Department of education (DoE)

The DoE must monitor the integration process and they should not be content with the fact that computers are present in schools. They need to follow up on their trainings and constantly devise strategies for the pedagogical integration of ICTs in schools. They should also ensure that progression is taking place.

5.6. Area for further study

Since the process of ICT integration has a cascading effect from National level to school level, there is much scope to investigate levels beyond the school as to the challenges faced by the department of education (DoE) in the implementation of ICT integration as well as what the structures are in place for implementation in schools. The area for further study should, therefore, focus on the: DoE intervention in influencing the pedagogical integration of ICT in South African schools (How does the DoE ensure that ICT integration is implemented in schools?) The reason for the suggestion of this study being that it is evident from the PanAfICT (2008) and from this particular research that South African public schools are not advancing ICT integration to levels that are in line with what the ICT in education policy advocates. In view of this, what is the DoE doing to ensure that ICT integration goals are achieved in terms of their plan or strategy? What constraining factors at National level challenges ICT integration at school level? Is there a system of monitoring progress at schools? This study will bring added light on the issue of evaluating progress in the ICT integration in schools as a starting point in addressing constraints and in developing strategies that will help schools move forward to achieve higher levels of ICT integration as stated in the ICT in education policy.

References

ACOT. (1995). *Changing the conversations about teaching, learning and technology: a report on 10 years of ACOT research*. Frenchs Forest, NSW: Apple Computer Australia Pty Ltd.

Al- Alwani, A (2005). *Barriers to Integrating Information Technology in Saudi Arabia Science Education*. Doctoral dissertation, the University of Kansas, Kansas

Albirini, A (2006). Teachers' attitudes towards information and communication technologies: The case of Syrian EFL teachers. Computers & Education, 47, 373 -398.

Ali Wan, W. Z., Nor, H.M. & Hamzah, A. Alwi, H. (2009). The conditions and level of ICT integration in Malaysian smart schools. International Journal of Education and Development using ICT,5, (2)

Al- Oteawi, S.M. (2002). The perceptions of administrators and teachers in utilizing information technology in instruction, administrative work, technology planning and staff development in Saudi Arabia, Doctoral dissertation, Ohio University, Ohio

Annan, K.(2005). Déclaration de M. Kofi Annan, secrétaire général de l'organisation des Nations Unies. Sommet mondial sur la société de l'information. Deuxième phase, 16 Novembre,Tunis.

Balanskat, A., Blamire, R. Kefalaq, S. (2006). The ICT Impact Report: A review of studies of ICT impact on schools in Europe. Pp 1-4. http://insight.eun.org/shared/data/pdf/impact_study.pdf Accessed November, 24, 2011

Banks, F., Leach, J. & Moon,B. (1999). New understanding of teachers pedagogic knowledge. London. Paul Chapman

Becta,(2004). A Review Of The Research Literature On Barriers To The Uptake Of ICT By Teachers. British educational communications and technology agency http://www.becta.org.uk. Accessed on January, 5, 2012

Bingimlas, K.A. (2009). Barriers to the successful Integration of ICT in Teaching and Learning Environments: A review of the Literature. Eurasia Journal of Mathematics, Science & Technology Education,5,(3), 235 – 245

Brannigan, N (2010). Enhancing Leadership Capacity in ICTs in Education through technology enabled Collaboration. http://www.gesci.org/assets/files/Enhancing%20Leadership%20capacity%20in%20ICTs%20in%20Education%20through%20Technology%20enabled%20Collaboration(1) Accessed on February, 10, 2012

Carnoy, M.,& Rhoten, D. (2002). What does Globalization mean for Educational Change? a comparative approach. Comparative Education Review,46,(1), 1-9

Castells, M.(2001) The New Global Economy, in: Muller, J; Cloete, N and Badat, S (Eds.). Challenges of Globalization: South African Debates with Manuel Castells (Cape Town, Maskew Miller Longman), 2-22.

Chigona, A., Chigona, W., Kayonga, P. & Kausa, M.(2010). An empirical survey on domestication of ICT in schools in disadvantaged communities in South Africa. International Journal of Education and Development using Information and Communication Technology (IJEDICT),6, (2).

Christie, P. (1996). Globalization and the Curriculum Proposals for the integration of education and training in South Africa, International Journal of Educational Development. 16 (4), 407 – 416.

Cohen, S. (2003). *Report on the Use of ICTs in Schools Research Project*. Johannesburg: South African Institute for Distance Education (SAIDE).

Cope, C., & Ward, P. (2002). Integrating learning technology into classrooms: The importance of teachers' perceptions, Educational Technology and Society, 5(1), 67-74 http://www.ifets.info/journals/5_1/cope.html. Accessed November, 13, 2011

Cox, M., Preston, C. & Cox, K. (1999a). What factors support or prevent teachers from using ICT in their classrooms? Paper presented at the British Educational Research Association. Annual Conference, Retrieved December, 23, 2011, from http://leeds.ac.uk/educol/documents/00001304.htm.

Department of Education, (2011) Curriculum and Assessment Policy Statement, Pretoria: Department of Education.

Department of Education, (2004) White Paper on e-EDUCATION, Pretoria: Government Gazette, 470, (26734)

Department of Education,(2003). *White Paper on e-Education, Transforming Learning and Teaching through Information and Communication Technologies,* Pretoria: Department of Education.

De Vos, A.S.(Ed.) (1998). Research at Grassroots: A Primer for the Caring Professions. Pretoria. Van Schaik, J.L

Dias, L. B. (1999). Integrating technology, *Learning & Leading with Technology*,27,(3), 10-21.

Divaharan, S., & Koh, J. H. L. (2010). Learning as students to become better teachers: Pre-service teachers' IWB learning experience. In M. Thomas & A. Jones (Eds.), Interactive whiteboards: An Australasian perspective. *Australasian Journal of Educational Technology*, 26(Special issue, (4), 553-570. http://www.ascilite.org.au/ajet/ajet26/divaharan.html Accessed January, 13, 2012

Earle, R.S. (2002). The Integration of Instructional Technology into Public Education: Promises and Challenges. Educational Technology,42,(1),5-13.

Empirica, (2006). Benchmarking access and use of ICT in European Schools, Final report from Head Teacher and classroom

Ertmer, P.A. (2005) Teacher Pedagogical Beliefs: The Final Frontier in Our Quest for Technology Integration, Educational Technology, Research and Development,53(4),25-39.

Ertmer, P.E.A. (1999). Examining teachers' beliefs about the role of technology in the elementary classroom, Journal of Research on Computing in Education, 32 (1), 54-72.

Fullan, M. (2001) *Implementing Change at the Building Level* [Online Accessed 2/2012 URL: http://www.michaelfullan.ca/Articles_01/08_01.htm

Gichoya, D. (2005). Factors affecting the Successful Implementation of ICT Projects in government. Electronic Journal of e- government,3, (4), 175- 184 Accessed January, 15, 2012

Goktas, Y., Yildirim, S., & Yildirim, Z. (2009). Main Barriers and Possible Enablers of ICTs Integration into Pre-service Teacher Education Programs. *Educational Technology & Society*, *12* (1), 193–204.

Govender, D., & Govender, I.(2010). Educator acceptance of information and communications technology (ICT) integration in teaching and learning in a developing country, In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2010*, 52-61. Chesapeake, VA: AACE.
Retrieved from http://www.editlib.org/p/34618 Accessed January, 30, 2012

Guidelines for Teacher Training and Professional Development in ICT,(2007). Department of Education. Pretoria.

Haynes, D. N. A. (2007). ICT and learning: Lessons from Australian classrooms. [doi: DOI: 10.1016/j. compedu. 2005.09.003]. *Computers & Education*, *49*(2), 385-395.

Hennessy, S., Ruthven, K. & Brindley, S.(2005). Teacher perspectives on integrating ICT into subject teaching: commitment, constrains, caution and change. Journal of Curriculum Studies,37, 155- 192.

Hennessy, S., Harrison, D. & Wamakote, L.(2010). *Teaching Factors Influencing Classroom Use of ICT in Sub- Saharan Africa* Itupale Online Journal of African Studies, 2 (2010) 39- 54 Cambridge and Dar es Salaam: Faculty of Education, University of Cambridge and Aga Khan University Institute for Educational Development - Eastern Africa Accessed December,21, 2011

Hooker, M. (2009). Using Cultural Historical Activity Theory (CHAT) to 'Mirror' ICT Integration in Teacher Professional Development
GeSCI Dublin, Ireland .mary.hooker@gesci.org. Accessed on November, 13, 2011

Hosman, L. (2011). Making the transition from pilot to scale: examining sustainability and scalability issues in a public–private telecenter partnership in Sri Lanka, *Information Technology for Development*, *17*,(3), 232-248.

Hughes, M. & Zachariah, S. (2001). An investigation into the relationship between effective administrative leadership styles and the use of technology, International Electronic Journal for Leadership in Learning,5, 1-10

Intel® Teach to the Future Manual, version 3.3, (2004). Intel® Corporation.

Isaacs, S. (2007). ICT in Education in South Africa Survey of ICT and Education in Africa: South Africa Country Report
www.infodev.org. Accessed on December, 21, 2011

Jones, R. (2003). Local and national ICT policies, In R. Kozma (Ed.).*Technology, innovation, and educational change: A global perspective,*163-194. Eugene, OR: International Society for Technology in Education.

John, P., & Sutherland, R.(2005). Affordance, opportunity and the pedagogical implications of ICT, *Educational Review*,*57*,(4), 405-413.

Jung, I. (2005). ICT-Pedagogy Integration in Teacher Training: Application Cases Worldwide, *Educational Technology & Society*, 8,(2), 94-101.

Kearney, G., & McGarr, O. (2009). The role of the teaching principal in promoting ICT use in small primary schools in Ireland. *Technology, Pedagogy and Education, 18*(1), 87 — 102.

Kirkland, K., & Sutch, D. (2009). *Overcoming the barriers to educational innovation, A literature Review*. Bristol: Futurelab

Kirschner, P & Selinger, M.(2003). The state of affairs of teacher education with respect to information and communication technology, Technology Pedagogy and Education, 12,5- 17.

Kozma, R., McGhee, R., Quellmalz, E., & Zalles, D.(2004). Closing the digital divide: evaluation of the World Links Program,. *International Journal of Educational Development, 25*,(4), 361-381.

Kozma, R. (Ed.). (2003). *Technology, Innovation and Educational Change: A Global* perspective, Eugene, OR.

Lewis, S. (2003). *Enhancing teaching and learning of science through use of ICT: Methods and materials,* School Science Review, 84,(309), 41- 51

Lim, C.P., Hang, D. (2003).An activity theory approach of ICT integration in Singapore schools. Computers and Education, National Institute of Education, Nanyong Technological University. Singapore. 49- 63.

Louis, K.S., Kruse, S., and Marks, H. (1996). School wide professional community. Fred Newmann and Associates (Ed.), Authentic Achievement: Restructuring Schools for Intellectual Quality. San Francisco: Jossey-Bass.

Majumdar,S (2006)Modelling ICT Development in Teaching & Learning

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Email: dr_majumdar@cpsctech.org

Mandinach, E.B. (2005). The Development of Effective Evaluation Methods for E-Learning: A Concept Paper and Action Plan. *Teachers College Record* [Online]. 107 (8), 1814-1835. Available from: Academic Search Premier http://www.library.dcu.ie/Eresources/databases-az.htm [Accessed December, 15, 2011]

Marshall, S & Taylor, W. (2007). Editorial: Using ICT to transform education International Journal of Education and Development using ICT, 3(1), 2-4.

McMillan J. H. & Schumacher S.(2010). Research in Education: Evidence-Based Inquiry (7th ed.). New York: Longman

Moll, I., & Ndlovu, N.S.(2009). Report on Phase One of the Pan African Research Agenda on the Pedagogic Integration of ICTs *(PanAf) –South Africa*

Mumtaz, S (2000): Factors affecting teachers' use of information and communications technology: a review of the literature, Journal of Information Techology for Teacher Education, 9:3, 319-342 **To link to this article:** http://dx.doi.org/10.1080/14759390000200096 accessed 11 February, 2012

Naidu, S., Cunnington, D. & Jasen, C.(2002). The experience of practitioners with technology- enhanced teaching and learning. Educational Technology & Society,5,(1), 23-34.
http://www.ifets.info/journals/5_1/naidu.html Accessed on January, 05, 2012,

Ndlovu, N.S. (2011). PanAf Edu,2, (4). Are South African in- service Teachers Adequately Prepared for ICT Integration?

Newhouse, P. (2002). Literature review: The impact of ICT on learning and teaching, Perth, Western Australia: Department of Education

Papert, S. (1997) *"The Connected Family, Bridging the Digital Generation Gap"* (UK, Long Street Press)

Pelgrum, W.J. (2001). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. Computers & Education, 37, 163 -178

Prensky, M. (2001). Digital natives, digital immigrant, On the horizon,9, (5), MCB University press.

SAIDE. (2003). *The Use of Computers in Schools*. SAIDE, Johannesburg.

SchoolNet South Africa (2005. *Teacher Competencies for ICT Integration*. Available at: http://www.school.za/edn/competencies.htm. [Accessed: September, 21, 2011].

Schrum, L., Strudler, N. & Thompson, A.(2011). ICTs and Teacher Competencies, Published by UNESCO institute for Information Technologies in Education. Moscow, Russian Federation 117292 Accessed January, 15, 2012

Scrimshaw, P. (Ed.)(2004). *Enabling teachers to make successful use of ICT*: Coventry: British Educational Communications and Technology Agency.

Shafika, (2006). *Towards a GeSCI Initiative on Teacher Professional Development in Africa,* Dublin: GeSCI

Sicilia, C. (2005). *The Challenges and Benefits to Teachers' Practices in Constructivist Learning Environments Supported by Technology*, Unpublished Master's Thesis. McGill University, Montreal

Terre'Blanche, M.T., Durrheim, K. & Painter, D. (2009). Research in practice: applied methods in practice. Cape Town:University of Cape Town Press.

Thornburg, D. (1997). Multimedia encourages New Learning Styles. Retrieved from http://www.hewhorizons.org/strategies/technology/thornburg.htm Accessed on October, 18, 2011

Tinio, V.(2002). ICT in Education. Retrieved from http://www.eprimers.org Accessed on September, 26, 2011

Toure, K., Tchombe, T.M.S., & Karsenti, T. (Eds.)(2008). ICT and Changing Mindsets in Education /Repenser l'éducation à l'aide des TIC.Bamenda, Cameroon: Langaa; Bamako, Mali: ERNWACA / ROCARE…Accessed September, 14, 2011

Trucano, M. (2005). *Knowledge maps: ICT in education*. Washington, DC: infoDev / World Bank. Available at: http://www.infodev.org/en/Publication.8.html. Acessed January, 21, 2012

UNESCO, (2008). *ICT Competency Standards for Teachers:- Implementation Guidelines, Version 1.0*. Retrieved , September, 24, 2011. http://www.unesco.org/en/competency-standards-teachers

UNESCO (2003) *"Developing and Using Indicators of ICT Use in Education"*

UNESCO- International Institute for Educational Planning. [Internet] Available from: <http://portal.unesco.org/ci/en/ev.php-URL_ID=12438&URL_DO=DO_TOPIC&URL_SECTION=201.html> [Accessed 5 January 2012]

UNESCO (2002). *Information and Communication Technology in Education. A Curriculum for Schools and Programme of Teacher Development*. Paris: UNESCO.

Unwin, T. (2004b). Towards a framework for the use of ICT in teacher training in Africa. *Open Learning: The Journal of Open and Distance Education* [Online]. 20(2) 113-129. Available from: http://www.gg.rhul.ac.uk/ict4d/ict%20tt%20africa.pdf [Accessed December, 27, 2011]

Wagner, D.A., & Daswani, C.J.(2006). *Bridges to the Future Initiative: Project update and research report*. Philadelphia, PA: International Literacy Institute, University of Pennsylvania.

Wang, P., & Chan, P. S.(1995). Advantages, disadvantages, facilitators and inhibitors of computer-aided instruction in Singapore's secondary schools. *Computers & Education*, 25, (3), 151-162

Wang, Q. (2008). A generic model for guiding the integration of ICT into teaching and learning: innovations in education and teaching international,45, (4), 411-419.

Wilson-Strydom, M.(2005). *Evaluation of Intel® Teach to the Future in South Africa. Year Two Evaluation*. Report prepared for SchoolNet SA and Intel® Teach to the Future in South Africa. Johannesburg: Neil Butcher and Associates.

http://www.isatt.org/ISATT-papers/ISATT-papers/Sanber2_TeacherEducatorsandtheIntegrationofICTintoEducationStudiesSequence.pdf (Accessed June 13, 2012)

http://www.ieducation.co.za/%E2%80%98model-c%E2%80%99-schools-need-to-be-supported/ (Accessed, June 13, 2012)

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Appendix

7.1 MANAGER QUESTIONNAIRE

To be completed by School Principals/ Directors & Heads of Department

This project's aim is to better understand how the pedagogical integration of ICT can enhance the quality of teaching and learning in Africa.

1. Name/location of Institution

_____

2. What is your role and designation in the school? _____

3. Do you have your own personal email address?

Yes _____ include (optional) _____ No_____

4. Total number of female managers (Heads of Department, Vice-principals, School Directors, non-teaching staff etc.) in your institution

_____

5. Total number of male managers (Heads of Department, Vice-principals, School Directors, non-teaching staff etc.) in your institution

_____

6. Briefly describe the different types of managers who work in your institution (the administrative structure – attach a diagram if necessary)

7. Total number of teachers in your institution _____

8. How many male teachers? _____ How many female teachers? _____

9. How many teachers in the institution have completed 1-50 hours of professional

development which included ICT training?

Number of Males _____ Number of Females _____

10. How many teachers have had more than 50 hours of professional development which included ICT training?

Number of Males _____ Number of Females _____

11. Have you (Institution Manager) had any ICT training?

Yes _____ No _____

12. If so, briefly describe the kind of training in ICT you have had *(Indicator 7.4.4)*

13. List the various ICT skills/competencies that you consider you have mastered

14. Indicate the total number of all courses taught in your institution _____

15. Indicate the total number of courses in your institution that integrate ICT in teaching and/or learning

_____

16. Provide a list of the course names, and a brief description of the way in which ICT is integrated in teaching and learning

17. Describe the impact ICT has had on teaching and learning in your institution (particularly on curriculum choices by educators)

18. Describe the impact of ICT on professional development/continuing education programs for employees from your institution

19. Describe the impact of ICT on education management practices at your institution

20. Does your institution have a plan for the integration of ICT?

Yes _____ No _____

21. Attach a copy, and/or description, of the integration plan, if no plan, please describe the context of absence of a plan

22. Who is responsible for ICT equipment maintenance in your institution?

_____

23. Does your institution/department have an ICT equipment maintenance and renewal plan?

Yes _____ No _____

24. Attach a copy, and/or description, of the maintenance and renewal plan

25. Does the community outside the school have access to your ICT facilities/infrastructure?

Yes _____ No _____

26. If Yes, describe the kind of access the outside community has (who has access, why, when, at what cost?)

27. In your opinion (as an institution manager), what are the major barriers hindering the achievement of your institution's ICT-related goals for learners?

28. Describe any particular "success stories", "pioneering initiatives", or "best practices", in the integration of ICT at your institution (what was done, by whom, how, with what results etc.)

29. To your knowledge, have any "ICT in education" related research publications

been produced by, or based on, your institution? (if possible, please attach a copy or summary,of the publication)

30. In general, what has been the impact of integrating ICT in your institution

31. What impact has integrating ICT had on the development of (as you understand this) relevant African course content?

32. What impact has integrating ICT had on learners at the institution who are qualified as having "special needs"?

33. To what extent does management influence the pedagogical integration of ICTs in this school?

Thank you for your time and effort in filling in this questionnaire.

7.2 Manager Interview form

1. Resources available:

Is the computer lab. Private or run by Gauteng on line?

_____

_____

How many computers are available for learners? _____Do learners have access to their own computer or do they have to share?

_____

What is the average number of learners in a class? _____

Do teachers have access to the computers for teaching and learning purposes? _____Have they used the computers? _____ was there any successes (explain)_____

_____

_____

What type of programmes are used (describe the software)?_____

_____

_____

2. Integration

What do you understand by the term ICT integration?

_____

_____

Why is it that ICTs has had a minor impact on teachers yet a significant impact on management at your school? (What has contributed towards the differences?)_____

_____

_____

_____

3. Technical support

Do you receive technical support?

_____

_____

_____

Who provides the technical support?

_____

_____

_____

What challenges do you experience regarding technical support?

_____

_____

_____

_____

_____

4. Professional Development

Are teachers IT skilled?

_____

_____

_____

Who uses the computer lab? (designations)

_____

_____

_____

What type of training has the teachers undergone in order to facilitate ICTs?

_____

_____

_____

5. Challenges/ factors facing ICT integration

What types of technological resources does the school have for teaching and learning e.g. smart board, TV, DVD video, OHP etc.?

_____

_____

_____

What factors influences ICT integration at your school?

_____

_____

_____

6. Management

What do you think about ICT integration in the classroom? Is it beneficial? Explain…How would you motivate teachers to integrate ICTs in their teaching and learning? If teachers undergo training, do you think that ICT integration would work in this school?

_____

_____

_____

_____

_____

_____

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7.3 EDUCATOR QUESTIONNAIRE

FOR TEACHERS AT ALL LEVELS

This project's aim is to better understand how the pedagogical integration of ICT can enhance the quality of teaching and learning in Africa.

Name of school: Grade taught: _____

Learning Area/s:

3.a) Do you have access to a computer in your school?

Yes _____ No _____

3.b) Do you have access to a computer out of school?

Yes _____ No _____

4. Do you have a personal email address?

Yes _____ No _____

5.a) Do you integrate ICTs in your teaching?

_____

5.b) How many hours per week do you use ICT for teaching purposes?

_____

5.c) Describe any impact that ICT has had on your lesson planning (how you prepare for classes).

7. Please attach a copy of a lesson planning document you have produced using ICT.

5.d) Describe any impact that ICT has had on your in-class teaching (what you teach, how you teach it, etc.)

5.e) Describe any impact that ICT has had on your evaluation methods (how you evaluate your students)

6. Describe any impact that ICT has had on communication between yourself and as an educator and your students (do you encourage questions asked via email, submission of assignments via email etc?)

7. Do you think that ICT helps you reflect on your teaching? (what you teach, how you teach) – if so, explain briefly with examples.

8. Explain briefly how ICT may have improved your own access to knowledge (information), as an educator.

9. Explain briefly how ICT has helped you in producing teaching material. Attach examples of material if possible.

10. Do you receive adequate technical support to ensure a smooth ICT integration process? (If Yes- What kind of support do you receive? If No- What kind of support do you need to ensure a successful integration process?)

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11. What type of training have you attended to develop your level of skills in ICT integration? Has the course attended been beneficial? Were you able to apply what was learnt to your teaching?

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12. What are some of the factors that either hinder or promote the pedagogical integration of ICT in your school?

Thank you for your time and effort in filling in this questionnaire.

7.4 Educator Interview Form

1. Name of school:

2. Describe the various ways that you use ICT for teaching purposes

    a. Which software do you use for planning, teaching, marking etc?

3. What factors do / would favour the integration of ICT in your teaching?

4. What are the challenges you experience (to) using ICT in your learning area / teaching?

5. What skills / competencies do you have &/or require to effectively integrate ICT in your teaching?

6. Please describe, in general, the impact that ICT has had **on learners'** learning?

7. Please describe, in general, the impact that ICT has had **on learners'** access to knowledge / info?

8. How has ICT helped your students in producing documentation related to learning – written assignments etc?
   (Please attach copies or descriptions of documents if possible – how ICT did help in their production)

9. Are you receiving adequate technical support to ensure a smooth ICT integration process?

10. Are there adequate resources (infrastructure, connectivity, software) available to successfully integrate ICT?

7.5 School Consent Form

Dear Sir/ Madam

I am an educator at school x who is currently studying my Masters in Education, specialising in ICT (Information and Communication Technology), at the University of the Witwatersrand. I would like to seek your permission to carry out my research project in your school.

My interest of study lies in the pedagogical integration of ICTs in South African schools. In our country's attempt to face the challenge of pressures exerted by the need to participate in the global economy, our education system has been coerced to incorporate or use ICTs in schools to prepare learners for participation in this emerging Information society. The South African Ministry for Basic Education through its provinces has made a concerted effort to provide resources, especially computers to schools, so that learners can be given the opportunity to learn and experience knowledge through a different and yet contemporary mode. It is in the interest of this study that I investigate factors enabling and constraining ICT integration in your school as I observe the progress your school has made toward reaching higher levels in using technology for teaching and learning since 2008 when data was first collected by the researchers for the PanAf Research Agenda on the Pedagogical Integration of ICTs in Educational Institutions.

In an attempt to gather data that hopefully, shall respond to some of the issues above, I request that you, as the school manager/principal and every teacher fill in a questionnaire. I would also request that I interview four teachers: 1 foundation phase teacher, 1 intermediate phase teacher, a senior phase teacher and the teacher responsible for the use of the computer laboratory. These are brief and should not take up more than fifteen minutes of the teachers' valuable time. I intend collecting the data in September 2011. The filling in and collection of the questionnaires may take one week and later, the interviews that should take a maximum of one week at breaks and after school, depending on when the participants are available. The data collected will later be presented to the PanAf Research Agenda on the Pedagogical Integration of ICTs in Educational Institutions which your school is already a partner and the researchers may use it to update their data base.

In order to protect the participant's confidentiality, pseudo names will be used in the presentation of this report

In order to satisfy the minimum requirements, as stipulated by the institution in which I am studying, prior to embarking on this research, consents from all participants are also necessary. Although I have planned to involve all teachers, I would like to assure them that their participation in this research is voluntary and they may withdraw their involvement at any time without affecting their reputation as employees in this school.

Your support and co-operation in this regard is highly appreciated.

T.Seegobin

I, _____ (manager/ teacher) in Grade _____, having read the above information regarding the study on pedagogical integration of ICTs within the school, give consent to participate in the interview as well as in the completion of the questionnaire from Mrs Tarishma Seegobin who is a student at the University of Witwatersrand.

_____ _____

Signature of educator/ manager Date

Educator consent form

I am an educator at school x who is currently studying my Masters in Education, specialising in ICT (Information and Communication Technology), at the University of the Witwatersrand. I would like to seek your permission to be interviewed for the purpose of this study.

My interest of study lies in the pedagogical integration of ICTs in South African schools. In our country's attempt to face the challenge of pressures exerted by the need to participate in the global economy, our education system has been coerced to incorporate or use ICTs in schools to prepare learners for participation in this emerging Information society. The South African Ministry for Basic Education through its provinces has made a concerted effort to provide resources, especially computers to schools, so that learners can be given the opportunity to learn and experience knowledge through a different and yet contemporary mode. It is in the interest of this study that I investigate factors enabling and constraining ICT integration in your school as I observe the progress your school has made toward reaching higher levels in using technology for teaching and learning since 2008 when data was first collected by the researchers for the PanAf Research Agenda on the Pedagogical Integration of ICTs in Educational Institutions.

In an attempt to gather data that hopefully, shall respond to some of the issues above, I request that you, as a representative of the educators at your school participate in the completion of the questionnaire/ and or the interview. These are brief and should not take up more than fifteen minutes of the teachers' valuable time. Prior arrangements shall be made to meet with you at your convenience. I intend collecting the data in September 2011. The data collected will later be presented to the PanAf Research Agenda on the Pedagogical Integration of ICTs in Educational Institutions which your school is already a partner and the researchers may use it to update their data base.
In order to protect participant's confidentiality, pseudo names will be used in the presentation of this report
In order to satisfy the minimum requirements, as stipulated by the institution in which I am studying, prior to embarking on this research, consents from all participants are also necessary. Although I have planned to involve all teachers, I would like to assure them that their participation in this research is

voluntary and they may withdraw their involvement at any time without affecting their reputation as employees in this school.

Your support and co-operation in this regard is highly appreciated.

T.Seegobin

I, _____ (teacher) in Grade _____, having read the above information regarding the study on pedagogical integration of ICTs within the school, give consent to participate in the interview as well as in the completion of the questionnaire from Mrs Tarishma Seegobin who is a student at the University of Witwatersrand.

7.6 Wits School of Education

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STUDENT NUMBER 0200508X

Protocol Number: 2011ECE086**C**

29 July 2011

Mrs. Tarishma Seegobin

27 Koester Street

Birch Acres 3

Kempton Park

1619

Dear Mrs. Seegobin

Application for Ethics Clearance: Master of Education

The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has considered your application for ethics clearance for your proposal entitled:

Factors enabling and constraining the pedagogical integration of ICT's in a South African

school.

The committee recently met and I am pleased to inform you that clearance was granted. The committee was delighted about the ways in which you have taken care of and given

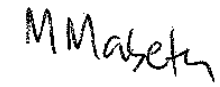
consideration to the ethical dimensions of your research project. Congratulations to you and your supervisor!

Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.

All the best with your research project.

Yours sincerely



Matsie Mabeta
Wits School of Education

Cc Supervisor: Ms. S. Ndlovu (via email)

7.7 Standard Edit

I, Nicholas K. Challis (MA), of the professional editors group (PEG), have started and completed an edit of a Masters degree by Mrs Tarishma Seegobin:

"Factors enabling and constraining the pedagogical integration of ICT in a South African school."

This took place during January and February 2012.

I have thoroughly checked her work.

Sincerely,

Nicholas

(w) 011 788 8669

Cell: 072 222 3814

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